IMPERIAL AGRICULTURAL
RESEARCH INSTITUTE, NEW DELHI.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND
CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

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VOL. I.—ELEVENTH SERIES.

LONDON:
PRINTED AND PUBLISHED BY TAYLOR AND FRANCIS, LTD.
1938.

"Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris, ex pulchritudine *sapientia* Domini ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata, à verè eruditis et sapientibus semper exculta, malè doctis et barbaris semper inimica fuit."—LINNÆUS

"Quel que soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations"—BRUCKNER *Théorie du Système Animal*, Leyden, 1767.

. . . . The sylvan powers
Obey our summons, from their deepest dells
The Dryads come, and throw their garlands
And odorous branches at our feet, the Nymphs
That press with nimble step the mountain-thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.
J TAYLOR, *Norwich*, 1818

ALERE FLAMMAM.

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THE
ANNALS AND MAGAZINE
OF
NATURAL HISTORY.

[ELEVENTH SERIES.]

“. . . . . .per litora spargite muscum,
Naiades, et circùm vitreos considite fontes:
Pollice virgineo teneros hic carpite flores:
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo.”
N. Parthenii Giannettasii, Ecl. 1.

No. 1. JANUARY 1938.

◆

I.—*Rugose Corals from the Mid-Avonian Limestones of West Glamorgan.* By EMRYS J. HOWELL, B.Sc., University College of Swansea.

[Plate I.]

IN 1911 Vaughan noticed “an early Clisiophyllid” in the Caninia Oolite of South Gower *, while more recently George (1933) recorded the same form “*Koninckophyllum*, sp. n.,” from the Caninia Oolite of the Vale of Glamorgan. During a study of the distribution of this new species two other new species, of *Cravenia* and of *Lithostrotion*, were found. Specimens of all three species agree in being strongly columate. Though much less common than other Rugosa in the Caninia Oolite and the C_2S_1 standard limestones of West Glamorgan, they constitute, together with a few Carcinophyllids and a few representatives of *Lophophyllum*, the great majority of columate corals in the mid-Avonian fauna. The object of this paper is to describe these new forms, particular attention being paid to features of ontogeny, and to make comparisons with structurally similar forms.

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* West Glamorgan localities mentioned in this paper are to be found on the 1″ Geol. Survey Maps, nos. 246, 247, 262.

I wish to thank Mr. D. R. A. Ponsford, M.Sc., for much help in the field, and Mr. Brian Simpson, M.Sc., for pertinent criticism. To Dr. H. Dighton Thomas thanks are extended for the interest he has shown in the work, for having had cut for me several sections of *Lithostrotion caswellense* and of similar Australian forms for comparison, and finally for reading the typescript. I thank Professor T. Neville George for constant encouragement, help, and discussion in both field and laboratory, and for guidance and valuable criticism in the preparation of the manuscript. I am also indebted to Dr. W. D. Lang, F.R.S., of the British Museum (Natural History), for providing facilities for examination of type and other specimens, and for the loan of material.

CRAVENIA Hudson.

Cravenia lamellata, sp. n.

(Pl. I. figs. 1–4 ; text-figs. 1 *a–f*, 2, 3)

General Features of the Holotype.

British Museum (Nat. Hist.) nos. R. 32123, 32124, 32125.

Horizon of the Holotype.—Top of the C_2 subzone.

Locality.—The Flats, Ogmore-by-Sea, Glamorgan.

The holotype was * a small ceratoid form with slight growth-restrictions and no vertical rugosity. Internally, the corallite shows 40 major septa, and small or insignificant minor septa, that abut proximally against a a thick epitheca. The distal extremities of the major septa are often slightly dilated. There are a few subparallel tabulæ and no dissepiments. The axial structure is prominent and occupies nearly half the diameter of the corallite ; it is composed of a thin medial plate, radial lamellæ which increase in number towards the periphery, especially in the counter region, and numerous subconcentric tabellar intersections (as seen in transverse section). A feature of the specimen is the great increase, in the later ephebic stages, in the number of lamellæ.

---

* The specimen has been cut into a series of sections. The specimens obtained from Ogmore are silicified and well preserved.

The medial plate in neanic stages continues into the cardinal cusp, but diminishes considerably in ephebic stages, when a thin lamellar extension of the medial plate is the main structural support of a slight cusp.

Transverse Section of the Ephebic Holotype (Pl. I. fig. 1).—There are 42 major septa, and an equal number of fairly well-developed minor septa, at a diameter of 15 mm. just below the calice: they do not reach the axial column, but the intermediate zone is often bridged by a narrow isthmus of tissue. A well-marked cardinal fossula has a short cardinal septum; alar fossulæ are marked by immature septa. There are few tabular intersections in the septal loculi.

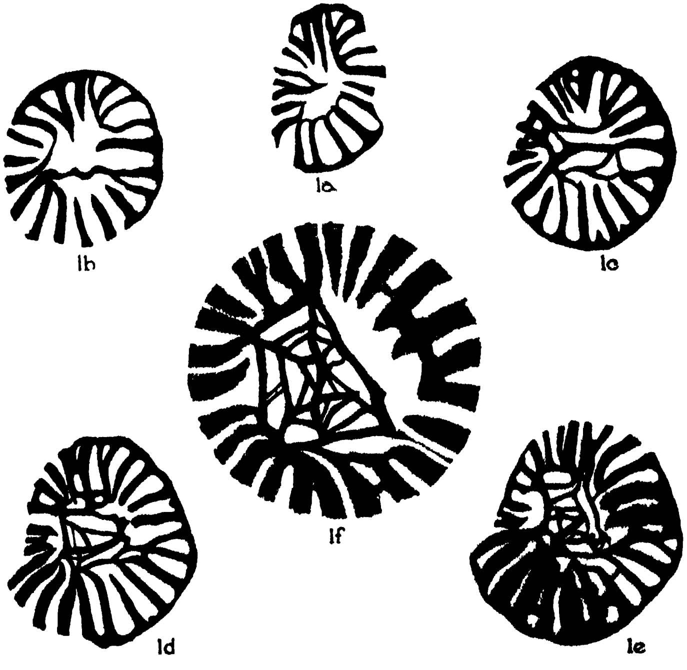
The axial column is almost round in outline; the short thin medial plate is confined to the central part of the column. About ten concentric tabellar intersections occur; they are closely aggregated, but evenly spaced, near the periphery. The principal lamellæ of the late neanic stages persist; the majority reach the medial plate but few of the numerous additional minor lamellæ do so. These minor lamellæ are chiefly developed in the counter region, by apparent irregular dichotomy of the principal lamellæ: their total number is equal to or slightly more than that of the major septa.

Description of Paratypes.

(a) *Longitudinal Section* (Pl. I. fig. 3).—A longitudinal section through the late neanic-early ephebic stages of a paratype shows the tripartite division, typical of the genus *Cravenia*, into an axial zone of highly inclined tabellæ flanked by almost horizontal tabulæ. The tabellæ are simple, sub-parallel, and inclined at an angle of about 70° to the horizontal; they meet in a thin medial plate. Peripherally, however, by an inward deflexion, they rest on previous tabellæ. The interseptal tabulæ are variously inclined, some are concave, others convex, but most are horizontal and impinge abruptly against the axial tabellæ.

(b) *Ontogeny* (text-figs. 1 *a–f*, 2, 3).—In most of the specimens, including the holotype, obtained from Ogmore, the proximal end of the corallite is insufficiently well preserved to ensure a complete analysis of ontogeny. These specimens show that an axial column is present at a very early stage. A non-columate stage is, however, preserved in one paratype. and text-figs. 1 *a–f* show serial sections of its proximal extremity.

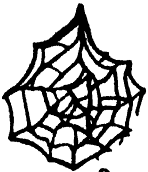
Early Neanic Stages.—The earliest stage recognized (text-fig. 1 *a*), at a diameter of 3 mm., has a zaphrentoid arrangement of 20 septa, some of which extend into the central area, but no vertical rod such as that of *Cravenia tela* Hudson is present. Succeeding sections (text-figs. 2 *b*, 2 *c*) reveal an invasion of the central area by tabulæ, which take on a regular arrangement (text-figs. 1 *d*, 1 *e*), and eventually one of these assumes a median position and has the appearance, in transverse section, of a medial plate traversing almost the whole width of the central area (text-fig. 1 *f*). At a diameter of nearly 5 mm. first signs of radial lamellæ and of a regular subconcentric



Text-fig. 1.—*Cravenia lamellata*, sp. n. Figs. 1 *a*–1 *e*, × 6¼; fig. 1 *f*, × 13. Camera-lucida drawings of serial transverse sections through the proximal end of a paratype. Early neanic stages. C_2, The Flats, Ogmore. [Brit. Mus.] no. R. 32118.

arrangement of the tabellæ can be distinguished. The development of the medial plate in this specimen is probably unique amongst Rugose corals in that the plate is a tabular element and not a septal element. In most Rugose corals the axial column "originates as a dilatation of the middle region of the axial septum" (Benson and Smith, 1923, pp. 163–4).

Middle Neanic Stages.—At a diameter of 9 mm. there are about thirty thickened major septa with an equal number of very short minor septa. The axial structure (text-fig. 2) shows a symmetrical development of four or five tabellæ around a short thin medial plate and traversed by ten principal lamellæ. One of these lamellæ, a linear continuation of the medial plate extends to the tip of a cardinal cusp.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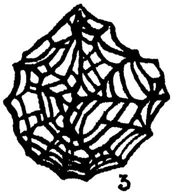
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Text-fig. 2.—*Cravenia lamellata.* Holotype. × 6½. Axial structure at middle neanic stage. Camera-lucida drawing. C_2, The Flats, Ogmore. [Brit. Mus.] no. R. 32115.

Text-fig. 3.—*Cravenia lamellata.* × 6½. Early ephebic axial structure of paratype figured in Pl. I. fig. 3. Camera-lucida drawing of distal transverse section. C_2, The Flats, Ogmore.

Late Neanic-Early Ephebic Stages.—There are forty major septa, long and not thickened, the auxiliary thickening of the previous stages having disappeared. The axial structure (text-fig. 3 shows the early axial structure of the paratype figured in Pl. I. fig. 3) begins to assume ephebic characters. It loses its angularity. The tabellæ have increased in number—there are ten or more intersections transected by the principal, and numerous secondary lamellæ. The short medial plate measures about one-third the diameter of the column, and bears the axial ends of several discontinuous principal lamellæ that alone traverse the central region. The axial column thus shows first traces of the division into inner and outer zones well demarcated in the ephebic transverse section.

Ephebic Stages.—A full description of the features of the adult corallite has been given above. The axial column has two zones: the inner zone consists of medial plate, axial parts of principal lamellæ, and a few tabellar intersections; the outer zone consists of eight or ten tabellar intersections crossed by the principal lamellæ and many secondary lamellæ. Serial sections of the calicular boss show a gradual degeneration of the outer zone and persistence of the principal lamellæ and medial plate—the latter to the tip of the boss.

Comparison with Cravenia rhytoides Hudson.

(a) *Comparative Dimensions.*—A superficial similarity exists between *C. lamellata* and *C. rhytoides*: the holotypes are both ceratoid forms with the same structural elements occupying the lumen, but considerable divergence occurs in the degree of development of these elements:—

	C. rhytoides. Holotype [*]. mm.	*C. lamellata.* Holotype. mm.
Length of corallite	30	33
Diameter of calice	18	21
No. of septa in ephebic stage	36	42
Diameter at which ephebic stage is developed	18	15
Diameter of ephebic corallite occupied by axial column	50 %	46 %
Length of medial plate [†]	66 %	70 %
No. of tabellæ per 5 mm.	6–7 [§]	12 [‡]
No. of tabulæ per 5 mm.	5–6 [§]	8 [‡]

(b) *The Axial Structure of the Ephebic Stage.*—In *C. lamellata* this is much more complex than in *C. rhytoides*. Tabellæ and tabulæ are more numerous in the former species, and little or no twisting of the lamellæ appears in the latter. The medial plate in *C. lamellata* is unthickened; in *C. rhytoides* it is very stout. In longitudinal section, the chief differences which justify separation of the two species are, firstly, the more compact nature of the axial column in *C. lamellata*, and, secondly, the lack of peripheral auxiliary thickening of the tabellæ in *C. lamellata*; this accounts for the absence in that species of a wall bounding the axial column—a feature well developed in *C. rhytoides*.

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[*] Measurements are those of the actual slices.

[†] Expressed as a percentage of the longer diameter of the axial column.

[‡] Obtained from the paratype figured in Pl. I. fig. 3.

[§] Approximate data; the longitudinal section figured by Hudson is about 4 mm. in length.

(*c*) *Ontogeny.*—In the brephic stage and early neanic stages there is a fundamental difference in the structure of the axial region in the two species. In *C. rhytoides* the medial plate is present at the brephic stage and is apparently an independent development, while in *C. lamellata* (see text-fig. 1, p. 4) the medial plate, absent in the zaphrentoid brephic stage, later develops as a tabellar element. In *C. rhytoides* the bounding wall is well developed; in *C. lamellata* it is entirely absent from these early stages. In the former species, the presence of the bounding wall at so early a stage suggests that it is a structure independent of tabellar elements, *i. e.*, it is not, as in the later stages of the holotype of *C. rhytoides*, developed as a sclerenchymal thickening of downwardly deflected tabellæ at the periphery of the axial region. Further, in the middle neanic stage of *C. rhytoides*, the tabellæ can be observed to terminate against this thick bounding wall at a fairly high angle.

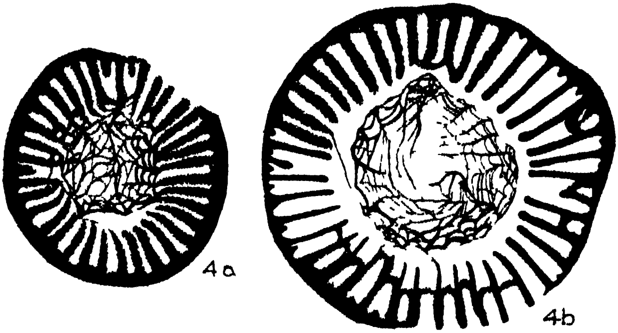
These striking differences in early ontogenetic features of the two species lend support to Hudson's assumption that the genus *Cravenia* is polyphyletic.

Cravenia lamellata, var.

(Pl. I. figs. 5–7; text-figs. 4 *a*, *b*.)

A single specimen from Ogmore, from the same bedding plane as the holotype of *C. lamellata*, differs from that specimen in that the central region of its ephebic axial column, unlike that of *C. lamellata*, and markedly unlike that of *C. rhytoides*, consists of an asymmetrical mass of irregular tabellæ and a few sinuous lamellæ The outer zone of the axial column is similar to that of *C. lamellata*; there are four or five subconcentric tabellar intersections crossed by numerous lamellæ, but these are fewer than in *C. lamellata*. A section through the calicular axial column shows the same essential structure, but a minute medial plate has reappeared (Pl. I. fig. 6). Sections through a late neanic stage and an early ephebic stage are figured in text-figs. 4 *a*, 4 *b*. These show similar features to corresponding stages of *C. lamellata*. A longitudinal section (Pl. I. fig. 7) of the region intermediate to the stages just mentioned, reveals tabellæ that are inclined axially at a fairly high angle to a thin eccentric vertical plate, and are continued downwards peripherally for a greater distance than those of *C. lamellata*. The tabulæ are slightly concave.

The degenerate ephebic central region of this variant is considered to be an advanced feature: it probably represents the rhodophylloid stage of an aulophylloid trend that may have affected these early clisiophyllids, although specimens showing complete degeneration of the axial structure into a vesicular mass are not known.



Text-fig 4.—*Cravenia lamellata*, var. Camera-lucida drawings of the distal and proximal transverse sections of specimen figured in Pl. I. fig. 7. Fig. 4 *a*, late neanic stage. Fig. 4 *b*, early ephebic stage. C_2, The Flats, Ogmore.

Cravenia spp.

Several apparently mature specimens from the same bedding plane as the holotype of *C. lamellata* differ from that specimen in diameter of the corallite and in their axial structure. One specimen approaches *C. tela*, but no corallites are certainly referable to either of Hudson's species.

Two specimens, probably conspecific, the one fully developed, the other immature, have an ephebic diameter of 12 mm., much less than that of *C. lamellata*. In the mature example, B.M. (Nat. Hist.) no. R.32123, the

38 major septa are comparatively longer than those of *C. lamellata*: the minor septa are short and inconspicuous. The axial column (Pl. I. fig. 8), 5 mm. in diameter, has irregular lamellæ variable in length and much fewer than the major septa; few reach the thin impersistent medial plate. A bounding wall is discernible in longitudinal section.

A single corallite, with a diameter of 14 mm. and 38 major septa, has an axial structure consisting of a thin medial plate, few irregular lamellæ, and numerous subconcentric tabellar intersections (as seen in transverse section). This axial structure is also found in *C. tela* but an impersistent bounding wall, absent in that species, is developed in the present specimen.

From Brandy Cove, Gower, at an horizon similar to that of the holotype of *C. lamellata*, a single specimen with a notable axial structure has been found. It has a diameter comparable with that of *C. lamellata*, lamellar and tabellar elements show extreme tenuity, a feature probably to be correlated with the development of an exceptionally thick bounding wall. The specimen, of which only the ephebic stage is known, is figured in Pl. I. fig. 9.

NOTES ON THE HORIZON OF *CRAVENIA*.

The holotype of *C. lamellata* and that of its variant, together with other species of the genus, were obtained from a bedding plane at The Flats, Ogmore, Glam. Here the attendant coral fauna consists of exceptionally large examples of *Siphonophyllia* and *Michelinia*; *Caninia cornucopiæ* occurs abundantly. A few feet below noncolumate lithostrotiontids appear for the first time; typical lithostrotions do not occur. Thus the horizon of the bedding plane falls within the C_2 subzone.

West of the Vale of Glamorgan, in the Gower peninsula, species of *Cravenia*, including *C. lamellata*, have been obtained from beds of comparable age at Brandy Cove, Heatherslade Bay, between Overton More and Mewslade.

In the Mid-Pennine Province, the holotype of *C. rhytoides* was obtained from beds that are stated to be of C_2 age. Thus it appears that the genus *Cravenia* is probably characteristic of beds of C_2 or, at most, of C_2S_1 age. Recently, however, a specimen of *Cravenia*, with a thick bounding wall, but otherwise comparable with *C. tela* Hudson, has been found by G. B. Alexander in the *Rylstonia costata* Beds at Damsgate, north of Ilam, N. Staffs; these beds are referred to the S_2 Zone.

KONINCKOPHYLLUM Thomson & Nicholson.

Koninckophyllum præcursor, sp. n.
(Pl. I. figs. 10-22; text-figs. 5 *a–c*.)

Description of Holotype.

British Museum (Nat. Hist.) no. R. 32126.

Horizon of the Holotype.—Caninia Oolite, Lower Caninia Zone.

Locality.—Caswell Bay, Gower, Glam.

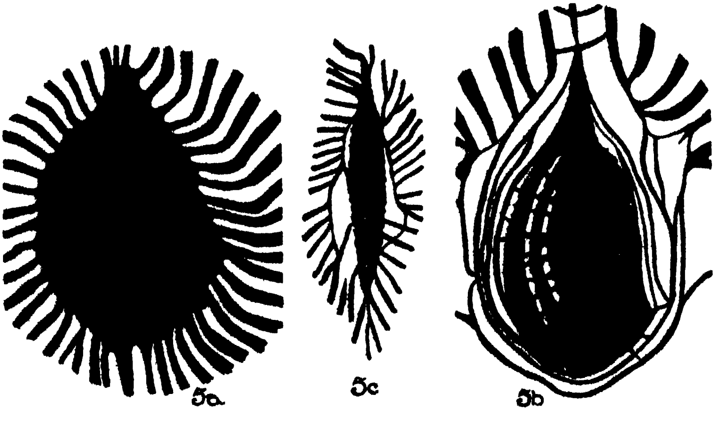
The holotype of this species is a single transverse section of a mature corallite (Pl. I. fig. 10). Its external features are not known; there is no epitheca present. Major septa number 46; they are mostly straight, but frequently show a geniculation distally near the point of junction with the axial column. Minor septa vary in length, but are usually more than half that of the major septa. A feature is the distal confluence of adjacent major septa to form a plate which continues to the axial column. A cardinal fossula is not well developed. Septal loculi are occupied by tabulæ and dissepiments.

The axial structure (text-fig. 5 *a*) is a compact fusiform column slightly cuspidate towards both counter and cardinal septa; of the two cusps the cardinal cusp is the more prominent. The internal structure of the column is masked owing to excessive auxiliary thickening. Radial lamellæ can, however, be faintly discerned by lines or fissures in the sclerenchyme, while a stout medial rod, centrally dilated, is a prominent feature; it runs into the cardinal cusp but fails to cross the counter region of the column.

Description of Paratypes.

A number of paratypes are known, and were obtained from the same locality as the holotype, and also from Ogmore, Glam. They agree in showing all the features of the holotype, which are, however, developed at diameters ranging from 12 to 24 mm. They further agree with the holotype in that no epitheca is present; the specimens appear to have been considerably eroded prior to preservation, for not only is the epitheca lacking in most specimens but the delicate dissepimental tissue is preserved in varying amounts.

Longitudinal Section.—An oblique section through a paratype (Pl. I. fig. 20) shows the axial column flanked by a tabularium and a peripheral dissepimentarium: the latter is wider than the tabularium. The dissepiments vary much in inclination: the compound tabulæ are less highly inclined and terminate against the axial column. No tabellar elements are discernible within the column.



Text-fig. 5.—*Koninckophyllum præcursor*, sp. n. Semi-diagramatic camera-lucida drawings of axial structures as seen in transverse section. *Fig.* 5 *a*, holotype. *Fig.* 5 *b*, carruthersellоid variant. *Fig.* 5 c, koninckophylloid variant, figured in Pl. I. fig. 17. Figs. 5 *a*, 5 *b*, Caninia Oolite, Caswell Bay. Fig. 5 *c*, The Flats, Ogmore. Fig. 5 *b*, [Brit. Mus.] no. R. 32141.

Ontogeny.—No complete specimen has been found, hence there is difficulty in making an adequate survey of ontogeny. From a number of fragmentary specimens showing early stages it is possible to ascertain the early history of the axial structure. This is initially developed as a dilatation of an axial septum; a dense mass composed of the ends of distally united septa then appears in which the prolonged counter and cardinal provide a medial plate (Pl. I. fig. 21). A further stage is represented by a retreat of the septa leaving their distal portions incorporated in the central mass which then has a dentate outline (Pl. I. fig. 22).

Variants.

A number of corallites vary from the holotype in the size and pattern of their axial structure. The features they show are due to either hypertrophy or non-development of one or more of the constituent elements of the column, these are medial plate, radial lamellæ, arched tabellæ.

These variants show divergence from the axial structure of the holotype in two well-marked directions. There is, firstly, a tendency to develop an open axial structure due to a paucity of auxiliary thickening and hypertrophy of lamellar elements: variants showing this axial structure are designated as carruthorselloid *. The tendency in the second direction is towards suppression of radial lamellæ and auxiliary thickening: these variants are koninckophylloid †.

Carruthorselloid Variants (Pl. I. figs. 14, 15, 19; text-fig. 5 *b*).—In transverse section the carruthorselloid axial column is pyriform in outline. The medial plate, which continues to the tip of the cusp, does not extend across the counter margin: it is flanked by a sclerenchymal zone of varying width. This central mass is surrounded by three or four sub-concentric tabellar intersections, one at least of which is well thickened. There is, in well-developed specimens, a large number of radial lamellæ (in the specimen figured in Pl. I. fig. 14 about 80) that by repeated irregular apparent dichotomy increase in number towards the periphery of the axial column, where alternate lamellæ are often prolonged to meet the attenuated distal ends of the major septa. The minor lamellæ do not traverse the intermediate tabular zone into the interseptal loculi. In some specimens the major lamellæ are not continuous with the septa; the column is then surrounded by unbreached tabellar intersections (text-fig. 5 *b*).

In longitudinal section (Pl. I. fig. 19) the structural elements are readily discerned. The axial column has compound tabellæ highly inclined to a persistent medial plate; tabellæ run down vertically at the periphery of the column; deposition of sclerenchyme occurs on one of every four tabellæ. The dissepimentarium is narrow and consists of highly inclined elements.

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* Cf. *Carruthorella compacta* Garwood.

† Cf. *Koninckophyllum magnificum* Thomson & Nicholson.

Koninckophylloid Variants (Pl. I. figs. 16–18; text-fig. 5 *c*).—The axial column in these variants is a narrow elongate structure consisting of medial plate and a number of short lamellæ or incorporated attenuated major septa, with little auxiliary thickening. The whole structure is plate-like and slightly dentate. There are few tabellæ (see text-fig. 5 *c*). In some specimens axial shortening of the septa together with atrophy of both lamellæ and of several tabellæ produce a small ovoid column surrounded by a tabular zone unbreached by septa (see Pl. I. fig. 18).

Other Variants.—One fragmentary specimen, a little more than 10 mm. in length, showed at one end an axial column like that of the holotype, *i. e.*, an oval compact structure (see Pl. I. fig. 12); this gave way, in a few millimetres, to an axial structure showing slight carruthersolloid features (Pl. I. fig. 13). It shows that radial lamellæ and a medial plate appear when auxiliary thickening ceases.

Two small specimens, the one from the Caninia Oolite of Caswell Bay, the other from that of Ogmore, have assumed a massive habit. They have an axial structure similar to that of the holotype.

Remarks.

A certain amount of variation in general can be correlated with the changes in axial structure; combinations of characters frequently produce variants which differ so much from the holotype that reference to other species or genera would be justified were intermediate variants unknown. Concomitant with the assumption of a koninckophylloid axial structure are changes in the dissepimentarium and septal elements; the former tends to increase in width, the latter to attenuate in passing outwards.

The diminution of the intensive auxiliary thickening of the axial structures similar to the holotype is to be correlated with the hypertrophy of lamellar elements to give the carrutherselloid type.

Comparisons.

Several variants of *K. præcursor* resemble the early ephebic stages of *Carruthersella compacta* Garwood[*], and, in fact, the writer was at one time disposed to refer them to that genus[†]. The similarities are, however, superficial only. The consistent development of minor lamellæ opposite the minor septa is not obtained in *K. præcursor*; the radial lamellæ in the former, though well cemented with sclerenchyme[‡], can easily be discerned under a hand-lens. No specimen of *K. præcursor* shows the proximal retreat of calicular septa—a feature considered to be of generic rank in *Carruthersella.*

The variation noticed in *K. præcursor* also appears in the comprehensive species of *Koninckophyllum* during *Dibunophyllum* times, notably in *K. columatum* George[§]. The latter species exhibits ephebic axial structures varying from a simple rod-like columella to the carrutherselloid axial column found in the earlier species: a lonsdaleoid border to the corallite, characteristic of *K. columatum*, is never developed in *K. præcursor.*

Koninckophylloid variants of *K. præcursor* were probably the structural forerunners of the great majority of Koninckophyllids of Dibunophyllum age, which include *K. proprium* Sibly and *K. magnificum* Thomson & Nicholson[||]; they far outnumber in D. times the strongly columate forms, abundant in mid-Avonian times, of which the aberrant *K. columatum* is a relic.

Distribution.

K. præcursor is a characteristic species of the Caninia Oolite throughout Gower and the western part of the

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[*] E. J. Garwood, 1912, p. 555.

[†] In T. N. George and D. R. A. Ponsford, 1935, p. 356.

[‡] I am indebted to Dr. H. Dighton Thomas for pointing out to me that the thickening of the axial column in the holotype of *C. compacta* is due to a deposit of sclerenchyme: the description given by Garwood—"closely-packed lamellæ usually in contact throughout"—suggests that the compactness of the column is solely due to the close proximity of the numerous radial lamellæ.

[§] T. N. George, 1927, p. 86, pl. ii. figs. 1–5.

[||] For a short discussion of the relation of *Koninckophyllum* to other Clisiophyllids see W. D. Lang, 1923, p. 132.

Vale of Glamorgan, but persists in reduced numbers into the Upper Caninia Zone. It occurs in the Caninia Oolite of Gower at Rotherslade, Caswell Bay, Heatherslade, Popples, Pennard Pill, Fall Bay, Broughton Bay, and in that of the Vale of Glamorgan * at the Flats, Ogmore: it occurs in beds of C_2 age at Caswell Bay and Seven Slades, Gower: in north-east Gower, at Hill Tor, one specimen has been obtained from S_1. The species has not been found elsewhere in the South-Western Province.

LITHOSTROTION Fleming.

Lithostrotion caswellense, sp. n.

(Pl. I. figs. 23–26, text-figs 6 *a k*.)

General Description of the Holotype.

British Museum (Nat. Hist.) nos. R. 32142–5.

Horizon of the Holotype.—C_2S_1.

Locality.—Caswell Bay, Gower, Glam.

Externally the colony, on which the following description is based, is similar to *L. martini* and other dendroid lithostrotiontids. The corallites are cylindrical and have a diameter of about 9 mm.; they are, on the whole, sub-parallel, but many have a tortuous habit. Daughter corallites arise by lateral offset. There are faint longitudinal striæ and annular corrugations on the epitheca.

The dissepimentarium is limited internally by a well-marked stereozone. There is a prominent axial column, which occupies about a quarter of the tabularium.

Transverse Section.—The mature corallite has two cycles of alternately long and short septa; they are evenly developed, with no fossulæ, hence the septal elements present a quasi-radial symmetry. There are thirty septa in each cycle. The major septa extend well into the tabularium, the minor septa for a short distance only. All septa abut on the epitheca and are bound together, on the periphery of the tabularium, by sclerenchymal thickening, which usually extends inwards for a short distance.

The axial structure is a stout column, ovoid in general outline and strongly cuspidate cardinally. It is well thickened with sclerenchyme, but under a hand-lens a medial rod and radial lamellæ can be detected. The medial rod does not cross the counter region of the column,

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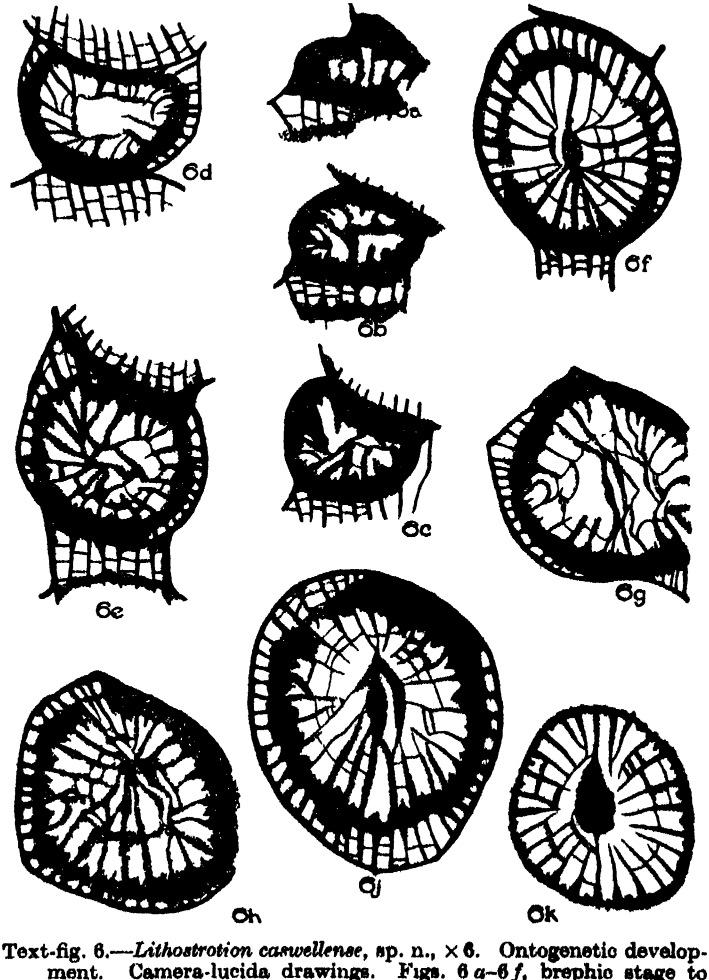
* For a full list of Caninia Oolite exposures and the fauna see T. N. George, 1933, pp. 237–39.



Text-fig. 6.—*Lithostrotion caswellense*, sp. n., × 6. Ontogenetic development. Camera-lucida drawings. Figs. 6 *a*–6 *f*, brephic stage to middle neanic stages of one specimen. Figs. 6 *g*–6 *k*, middle neanic stages of another specimen. Intermediate distances: figs. 6 *g*–6 *h*, 1 mm., figs. 6 *h*–6 *j*, 1·5 mm., figs. 6 *j*–6 *k*, 1·1 mm.

Each section is orientated with the parent corallite below the daughter corallite: figs. 6 *a*–6 *f* include part of an adjacent corallite above. These sections were obtained from parts of the holotype.

while lamellæ are fewer than, and not continuations of, the major septa; only occasionally, in the mature corallite, do the septa extend to the axial column, when they frequently link up with the lamellar extremities.

Longitudinal Section (Pl. I. fig. 24).—The corallite shows a solid axial column: auxiliary thickening obliterates its detailed structure, but a persistent medial rod can faintly be discerned. The dissepiments are small and numerous. There is great variation in width of the dissepimentarium; on the convex side of a corallite as many as four rows of dissepiments may appear, while on the concave side their development may be suppressed, when the stereozone and epitheca are confluent. Typically developed, see Pl. I. fig. 24, the dissepimentarium consists of two or three rows of elements. A feature well shown in other dendroid forms (see Smith, 1916, text-fig. 2) also appears in this species: when two or more adjacent corallites are concurrent for a short distance their dissepimentaria merge, but a thick mutual epitheca is retained. In longitudinal section it is seen that when the corallites part another epitheca is formed, into which the conjoint epitheca runs at right angles.

The tabulæ are compound, leave the stereozone at a high angle, then after making a small downfold near the periphery of the tabularium turn upwards to abut on, and often to support, another series of tabulæ. These are highly inclined and slightly convex outwards; they run into the axial column at a low angle. When seen in a tangential section they are strongly convex upwards, and are seen to be structures which rest upon, and therefore distinct from, the peripheral tabulæ. They are incipient tabellæ.

Ontogeny.

The following description is based on serial sections of several daughter corallites, camera lucida drawings of two of which are given in text-figs. 6 *a–k*. In the earliest stages no distinct division of the corallite into counter and cardinal regions is apparent. It is not until the late neanic stage is reached, when the cardinal cusp is initiated, that the cardinal and counter septa can be distinguished: the counter septum usually occurs on that side of the offset nearest the parent. The place of origin of an offset in the parent branch is apparently unrelated to the location of fossulæ.

Brephic Stage.—The daughter corallite is apparently initiated in the stereozone. Several septa of the parent branch immediately below the offset undergo intense auxiliary thickening preparatory to increase; the stereozone gradually migrates outwards and at the end of this stage disrupts the epitheca (text-figs. 6 *a*, 6 *b*). During this stage the first septa and the epitheca of the offset appear. The tabularium is narrow, and all elements are well thickened.

Early Neanic Stage (text-figs. 6 *c–e*, 6 *g*).—The tabularium widens and is penetrated by irregular, long, major septa and a few tabulæ. Minor septa attain their adult features during the later steps of this stage, when also the stereozone migrates inwards from the epitheca; no distinct dissepiments, however, are developed. As seen in transverse section there is a persistent zone of dissepimental tissue between the corallites which gradually narrows to an isthmus. This stage is noncolumate.

Middle Neanic Stage (text-figs. 6 *f*, 6 *h–j*).—One major septum, usually one in the region nearest the parent, straightens and undergoes a dilation of its axial extremity due to auxiliary thickening; it is met by two or more major septa from the opposite region, but no definite axial septum is formed. The stereozone migrates further inwards and dissepimental tissue appears. Alar fossulæ and a pinnate symmetry of the septal elements are characteristic of this, the "lithostrotion stage" (see also Pl. I. fig. 25).

Late Neanic Stage (text-fig. 6 *k*, of the tabular region only).—During this stage radial lamellæ appear in the strongly dilated axial column; the latter begins to attain its ephebic outline—a rounded counter part and a strong cardinal cusp. The lamellæ are distinct in origin from the septa, which do not reach the axial column at this stage. The pinnate symmetry persists. The zone of dissepiments widens.

Ephebic Stage.—A subradial symmetry of the septal elements is attained, due to disappearance of alar fossulæ, Major septa frequently extend to the axial column and link up with the radial lamellæ.

Comparisons.

(a) *With* Lithostrotion stanwellense *Etheridge fil.*—The two species possess the same characters and frequently developed to a similar degree: they are both dendroid lithostrotiontids with a stout axial column traversed by septal lamellæ. The Australian species occurs in the Star Series, Queensland, and in the Burindi Series, New South Wales, and is associated with both fasciculate and massive lithostrotiontids.

Comparative Dimensions.—

	L. stanwellense *.		*L. caswellense.*
	mm.	mm.	mm.
Diameter of corallite	5 7	9–11	9-10
Number of major septa	20	24-30	30
Diameter of tabularium	4-6	7-8	6
Width of axial column	14-15 %	15 % †	16-18 %
Number of tabulæ per 5 mm....	10	5 †	8–9

Both species have a quasi-radial arrangement of the septa in the mature corallite: the minor septa project further beyond the stereozone in *L. stanwellense*. The stereozone is only feebly developed in that species. The dissepimentarium in *L. caswellense* is wider than, and has not the lonsdaleoid tendency of, that in *L. stanwellense*.

The axial structure of *L. caswellense* is the more compact, and has the more regular outline, for in *L. stanwellense* auxiliary thickening frequently migrates along the unincorporated parts of the major septa to produce, as seen in transverse section, a "spiked" axial column. The "lamellæ" of *L. stanwellense* ar apparently the incorporated ends of major septa, while in *L. caswellense* these elements are distinct in origin from, but may become confluent with, the major septa. The axial column of *L. stanwellense*, unlike that of *L. caswellense*, persists into the mature corallite as a prominent feature.

In longitudinal section, the chief difference between the two species lies in the nature of the tabellæ: these in *L. stanwellense* are globular structures, strongly convex outwards; in *L. caswellense* they tend to be conical with a tendency towards concavity.

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* The first series of numbers given for *L. stanwellense* are those of specimen no. R. 19743 in the British Museum (Nat. Hist.): the second series are given by Benson and Smith, 1923, p. 168.

† *Ibid.* pl. i. figs. 3, 6.

L. stanwellense is the nearest structural relative of the Caswell species, and several corallites of the former are almost identical with those of the latter. These two species are congeneric, synchronous, homœomorphic developments in widely separated regions.

(b) *With other British Lithostrotiontids.*—Some aberrant corallites of *Lithostrotion martini* Edwards & Haime are similar in transverse section to *L. caswellense*. The highly inclined incipient tabellæ, so prominent a feature of *L. caswellense*, are frequently met with in *L. basaltiforme*.

Horizon.

The holotype colony was found in the coast section to the west of Caswell Bay at about 140 feet above the Modiola Phase and 35 feet above the Goniatite Bed *. A prolific coral-brachiopod fauna † of C_2 age occurs in beds within a few feet below, but a sudden dying out of this fauna, with no accompanying lithological change, is apparent in those strata immediately below that in which *L. caswellense* occurs; this bed lies near the base of well-marked gastropod beds. The stratum containing *L. caswellense* is of uppermost C_2 age.

NOTES ON ASSOCIATED LITHOSTROTIONTIDS.

Several colonies of diphymorphic lithostrotiontids have been located in the Caswell Bay–Brandy Cove coast section in the 50 feet of strata below the *L. caswellense* Bed. No lithostrotiontids occur for a considerable distance in overlying beds, but a small colony, doubtfully referable to *L. martini* Ed. & H., has been found 50 feet above the *L. caswellense* Bed.

? *Diphyphyllum* sp.

One colony, about 15 inches in diameter, has corallites up to 12 mm. in diameter. The major and minor septa number 60, and in many corallites terminate axially against a thin aulos. It occurs 15 feet below the Goniatite Bed.

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* See George and Ponsford, 1935, pp. 356–7.

† *Ibid.* p. 357.

{*Diphystrotion*} sp.

A large colony, with a corallite diameter of 5–8 mm. The corallites are but rarely columellate. Major septa number 26; the minor septa are short. It occurs 20 feet above the Goniatite Bed.

Lithostrotion sp.

The corallites are 9–10 mm. in diameter, and are strongly columellate; most have a strong axial septum reached by major septa and slightly dilated axially. Major septa number 26. A narrow stereozone is breached by short minor septa. The colony occurs 25 feet above the Goniatite Bed.

Diphyphyllum sp.

Occurring in the *L. caswellense* Bed there are numerous scattered corallites, about 8–9 mm. in diameter, and but rarely associated in small colonies. Major septa number 30. The corallites are characterized by exceptionally thin septal and tabular elements and an ill-defined stereozone. The dissepiments are relatively large; tabulæ are irregularly inclined, but axially flattened.

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EXPLANATION OF PLATE I.

(All figures, × 1⅓.)

Fig. 1. *Cravenia lamellata*, sp. n. Holotype. Transverse section through base of calice. Ephebic stage. C_2, The Flats, Ogmore. [Brit. Mus.] no. R. 32113.

Fig. 2. Ditto. Holotype. T.S. early ephebic stage. C_2, The Flats, Ogmore. [Brit. Mus.] no. R. 32114.

Fig. 3. Ditto. Paratype. L.S. late neanic stages. C_2, The Flats, Ogmore. [Brit. Mus.] no. R. 32116.

Fig. 4. Ditto. Paratype. L.S. ephebic stages and calice. The Flats, Ogmore. [Brit. Mus.] no. R. 32117.

Fig. 5. *Cravenia lamellata*, var. T.S. ephebic stage. C_2, The Flats, Ogmore. [Brit. Mus.] no. R. 32120.

Fig. 6. Ditto. T.S. through the calicular axial structure. C_2, The Flats, Ogmore. [Brit. Mus.] no. R. 32121.

Fig. 7. Ditto. L.S. late neanic-early ephebic stages. C_2, The Flats, Ogmore. [Brit. Mus.] no. R. 32122.

Fig. 8. *Cravenia* sp. T.S. through the ephebic calicular axial column. C_2, The Flats, Ogmore. [Brit. Mus.] no. R. 32124.

Fig. 9. *Cravenia* sp. T.S. through calice. C_2, Brandy Cove, Gower. [Brit. Mus.] no. R. 32125.

Fig. 10. *Koninckophyllum præcursor*, sp. n. Holotype. T.S. ephebic stage. Caninia Oolite, Caswell Bay, Gower. [Brit. Mus.] no. R. 32126.

Fig. 11. Ditto. Paratype. T.S. ephebic stage. Caninia Oolite, Caswell Bay, Gower. [Brit. Mus.] no. R. 32127.

Fig. 12. Ditto. Paratype. T.S. ephebic stage. Caninia Oolite, The Flats, Ogmore. [Brit. Mus.] no. R. 32128.

Fig. 13. Ditto. Paratype. T.S. ephebic stage. The same specimen as in fig. 12; see text, p. 13. Caninia Oolite, The Flats, Ogmore. [Brit. Mus.] no. R. 32129. This figure is inverted.

Fig. 14. Ditto. Carruthersellоid variant. T.S. ephebic stage. Caninia Oolite, Caswell Bay. [Brit. Mus.] no. R. 32130.

Fig. 15. Ditto. Carruthersellоid variant. T.S. Caninia Oolite, Caswell Bay. [Brit. Mus.] no. R. 32131.

Fig. 16. Ditto. Koninckophylloid variant. T.S. Caninia Oolite, The Flats, Ogmore. [Brit. Mus.] no. R. 32132.

Fig. 17. Ditto. Koninckophylloid variant. T.S. Caninia Oolite, The Flats, Ogmore. [Brit. Mus.] no. R. 32134.

Fig. 18. Ditto. Koninckophylloid variant. T.S. Caninia Oolite, The Flats, Ogmore. [Brit. Mus.] no. R. 32135.

Fig. 19. Ditto. Carruthersellоid variant. L.S. Caninia Oolite, Caswell Bay. [Brit. Mus.] no. R. 32137.

Fig. 20. Ditto. Paratype. L.S. Caninia Oolite, Caswell Bay. [Brit. Mus.] no. R. 32138.

Fig. 21. Ditto. Early neanic stage. T.S. Caninia Oolite, Caswell Bay. [Brit. Mus.] no. R. 32139.

Fig. 22. Ditto. Neanic stage. T.S. Caninia Oolite, Caswell Bay. [Mus. Brit.] no. R. 32140.

Fig. 23. *Lithostrotion caswellense*, sp. n. Holotype. T.S. ephebic corallites. C_2, Caswell Bay, Gower. [Brit. Mus.] no. R. 32142.

Fig. 24. Ditto. Holotype. L.S. ephebic corallite. C_2, Caswell Bay. [Brit. Mus.] no. R. 32143.

Fig. 25. Ditto. T.S., one corallite shows the plate-like axial structure and pinnate symmetry of septa of the middle neanic stage. C_2, Caswell Bay. [Brit. Mus.] no. R. 32146.

Fig. 26. Ditto. T.S., an ephebic corallite and diphymorphic daughter corallite. C_2, Caswell Bay. [Brit. Mus.] no. R. 32148.

II.—*A Brief Survey of the Species of Mallophaga described from* (3) *Procellariiformes and* (4) *Pelecaniformes.* By GORDON B. THOMPSON.

THE two tables given below are drawn up in the same way as those given in previous papers of this series (Thompson, 1937). The type-hosts of the species of Mallophaga described to date are the only records taken as a basis for this analysis.

In the case of the Procellariiformes twenty-four genera are listed by Peters in his 'Check-List of Birds of the World' (1931). Seventeen of these genera have species of Mallophaga described from them. All the genera of Mallophaga listed in the table are confined to species of Procellariiformes except *Menopon*, *Colpocephalum*, and *Philopterus*, which in their present status occur on a very

TABLE A.

Genera of Procellariiformes	Genera of Mallophaga.															
	Menopon.	*Colpocephalum.*	*Ancistrona.*	*Philopterus.*	*Perineus.*	*Pseudonirmus.*	*Harrisoniella.*	*Naubates.*	*Halipeurus.*	*Synnautes.*	*Episbates.*	*Pelmatocerandra.*	*Philoceanus.*	*Docophoroides.*	*Trabeculus.*	*Giebelia.*
Diomedea	×	×	—	—	×	—	×	×	—	—	×	—	—	×	—	—
Phœbetria	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—
Macronectes	—	—	—	×	×	—	—	—	—	—	—	—	—	—	×	—
Daption	—	—	×	—	×	×	—	×	—	—	—	—	—	—	—	—
Fulmarus.......	×	—	×	×	×	—	—	—	—	—	—	—	—	×	—	—
Halobæna	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—
Phachyptila	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—
Priocella	—	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—
Adamastor	×	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—
Procellaria	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×
Puffinus	×	—	—	×	—	—	—	×	×	—	—	—	—	—	×	×
Pterodroma	—	×	—	—	—	—	—	×	×	—	—	—	—	—	×	×
Pagodroma	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—
Oceanites	—	—	—	×	—	—	—	—	—	×	—	—	—	—	—	—
Hydrobates......	—	—	—	×	×	×	—	—	—	×	—	—	—	—	—	—
Oceanodroma	—	×	—	—	—	—	—	—	—	×	×	—	×	—	—	—
Pelecanoides	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—

wide range of hosts. I have omitted certain species at present placed in *Esthiopterum* as there is some doubt as to their status.

With regard to the Pelecaniformes, nine genera are listed by Peters, (1931) all of which have had one or more species of Mallophaga described from them. Of the eight genera of Mallophaga listed *Pectinopygus* sens. lat. occurs on all the Pelecaniformes except Phaëthontidæ. The genus *Tetrophthalmus* is entirely confined to Pelecanidæ and Phalacrocoracidæ. *Eulæmobothrion* seems to occur exclusively on birds frequenting aquatic habitats. The genus *Actornithophilus* occurs at least for the most part on Laridæ, Alcidæ, and Charadriidæ. The remaining genera of Mallophaga, i.e., *Menopon Colpocephalum*, and *Philopterus*, are, as stated above, parasitic on a very wide range of hosts. In the case of the genus *Degeeriella* recorded from Anhingidæ I have already pointed out in a previous paper (Thompson, 1937) that the two known species should almost certainly be placed in *Pectinopygus* sens. lat.

TABLE B.

Genera of Peleconiformes.	Genera and subgenera of Mallophaga.										
								Pectinopygus.			
	Menopon.	*Colpocephalum.*	*Actornithophilus.*	*Tetrophthalmus.*	*Eulæmobothrion.*	*Philopterus.*	*Degeeriella.*	*Epipelicanus.*	*Pectinopygus.*	*Philichthyophaga.*	*Epigregata.*
Phaethon	×	—	×	—	—	×	—	—	—	—	—
Pelecanus	—	×	—	×	—	—	—	×	—	—	—
Morus	×	—	—	—	—	×	—	—	×	—	—
Sula	—	—	—	—	—	—	—	—	×	—	—
Phalacrocorax .	×	—	—	—	×	—	×		—	×	—
Haliëtor	×	—	—	×	—	—	—	—	—	×	—
Nannopterum .	—	—	—	—	—	—	—	—	—	×	—
Anhinga	—	—	—	—	—	—	×	—	—	—	—
Fregata	×	×	—	—	—	—	—	—	—	—	×

The absence of any known species of *Pectinopygus* from the Phaëthontidæ is of interest since these tropic birds appear to have affinities with the Laridæ (Gulls, Terns). These affinities are substantiated by the fact that a species of the genus *Actornithophilus* is found upon them.

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III.—Idatiella *China*: *Two new Species, with a Key* (*Hemiptera*, Miridæ). By HARRY H. KNIGHT, Iowa State College, Ames.

DISTANT (1910) described the genus *Idatius* from India, founded on a single new species, *priscillianus*. China (1926) pointed out that *Idatius* Distant was preoccupied by a Coleopterous genus of the same name, and proposed a new name, *Idatiella*.

Mr. W. E. China, of the British Museum, sent to the writer certain specimens of this genus for study, with the result that two new species are herewith described. The genus *Idatiella* appears to be most closely related to *Microphylellus* Reuter, and at present the writer is uncertain as to how the two groups may be separated. *Microphylellus minor* Kngt. and *M. flavicollis* Kngt., described from California and Oregon, have the very suggestive white base of cuneus, pale tibia with dark spines minus setigerous dots.

Idatiella albisignata, sp. n.

Allied to *priscillianus* Dist., but distinguished by the elongate white spot on basal half of corium, bordering upon and invading the clavus.

♂.—Length 3·5 mm., width 1·3 mm. Head: width ·73 mm., vertex ·3 mm., ecarinate. Rostrum, length 1·08 mm., just attaining hind margins of intermediate coxæ. Antennæ: segment I, length ·22 mm., pale yellowish, finely pubescent, inner surface provided with two or three dark bristles; II, 1·04 mm., cylindrical, black, closely and finely pubescent; III, ·60 mm., pale fuscous; IV, ·30 mm., fuscous. Pronotum: length ·56 mm., width at base 1·04 mm., disk moderately convex, slightly shining, transversely rugulose but not punctate, clothed with recumbent, simple pale pubescence. Scutellum moderately, evenly convex, finely transversely rugulose: mesoscutum moderately exposed. Hemelytra with embolar margins nearly parallel, slightly wider apically; clothed with rather fine, simple pubescence; cuneus moderately declivent, strongly incised at base, length equal to twice width at base; membrane full, uniformly dark fuscous. Legs similar in type to that found in the genus *Microphylellus*; tibia pale, hind pair provided with fourteen pairs of fine black spines, setigerous dots absent.

Colour black, basal one-third of cuneus white, an elongate area on basal half of corium bordering upon and slightly invading the clavus, translucent white. Legs pale yellowish, bases of coxæ and the tarsi fuscous, hind femora except base brownish black, tibial spines black.

♀.—Length 2·7 mm., width 1·3 mm., embolar margins slightly arcuate. Form more robust, but pubescence and coloration very similar to the male. Head: width ·71 mm., vertex ·35 mm., wider and more convex than in the male. Antennæ: segment I, length ·17 mm.; II, ·82 mm., basal half slightly more slender, pale yellowish, apical half black; III, ·50 mm., black, pale at base; IV, ·23 mm., fuscous. Pronotum: length ·50 mm., width at base 1·05 mm.

Holotype: male, Nov. 16, 1931, Nelson, New Zealand, breeding on apple in the "Research orchard" (*C. J. Dumbleton*); British Museum of Natural History. *Allotype* female, *paratype* male and several nymphs taken with the type *.

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* [A male and female collected by W. Cottier at Hastings on apple-trees infested with the "red spider," *Paratetranychus pilosus* C. & F., differ from the Nelson specimens in smaller size and shorter antennæ, but there is no appreciable difference in the male genitalia. Reported by Mr. J. Muggeridge as suspected of feeding on eggs of the "clover mite," *Bryobia prætiosa* Koch.—W. E. China.]

Idatiella chinai, sp. n.

Differs from *priscillianus* Dist. in the slightly longer and entirely black second antennal segment. Mr. China states that the hind tarsus is distinctly longer than in *priscillianus*.

♀.—Length 2·8 mm., width 1·14 mm. Head: width ·65 mm., vertex ·35 mm., ecarinate although with a sharp posterior margin. Rostrum, length 1·3 mm., attaining posterior margin of hind coxæ, black, pale on apical half except apex. Antennæ: segment I, length ·17 mm., black; II, ·82 mm., slightly clavate, apical half thicker than segment I, entirely black; III, ·40 mm., pale; IV, ·26 mm., pale fuscous. Pronotum: length ·48 mm., width at base ·98 mm. Hemelytra with embolar margins slightly arcuate; dorsum slightly shining, impunctate, clothed with pale and fuscous, recumbent, simple pubescence.

Colour black, basal two-fifths of cuneus white, almost lunate; membrane uniformly dark fuscous. Legs pale to yellowish, hind femora brownish black, tibia with dark spines, setigerous dots absent.

♂.—Length 2·8 mm., width 1·16 mm.; hemelytra only very slightly wider near cuneus. Form slightly more slender but very similar to female in coloration and pubescence. Head: width ·68 mm., vertex ·28 mm. Antennæ: segment I, length ·19 mm.; II, ·95 mm., thickness ·08 mm., nearly cylindrical but thicker than segment I; III, ·36 mm., white; IV, ·26 mm., dusky. Pronotum: length ·48 mm., width at base 1·04 mm.

Holotype: female, Kodai Kanal, South India (*T. V. Campbell*); British Museum Natural History. *Allotype*, taken with the type (author's collection). Named in honour of Mr. W. E. China, who first recognized this species as undescribed.

Key to the Species of Idatiella.

1. Corium uniformly black .... 2.
Corium with elongate white mark bordering upon and slightly invading the clavus .... *albisignatus* Kngt.
2. Antennal segment I and base of segment II pale .... *priscillianus* Dist.
Antennal segments I and II uniformly black... *chinai* Kngt.

IV.—*A new Species of* Hydrotetrix *from the Marquesas Islands, with a Key to the Genus* (*Orthoptera*, Acrididæ, Acrydiinæ). By E. R. Tinkham.

Among some Acrydiinid material forwarded to the writer for study by Dr. T. H. Hubbell, of the University of Michigan, were several specimens of *Hydrotetrix* representing a new species from the Marquesas Islands.

I am very grateful to Mr. Morgan Hebard for the privilege of studying his excellent collection in the Academy of Natural Sciences of Philadelphia. In it are specimens of the three known species, namely, twelve paratypes of *Hydrotetrix marquesana* Hebard, three topotypes of *H. cheesmanæ* Uvarov, and a series of specimens of *H. aspera* Uvarov.

These I have studied, and present below a key to the genus and the description of the new species.

Hydrotetrix Uvarov.

1926. *Hydrotetrix* Uvarov, Ann. & Mag. Nat. Hist. (9) xvii. p. 654, 2 text-figs.

When the genus was described Uvarov stated that *Hydrotetrix* was "probably allied to *Mazarredia*." The writer believes that *Hydrotetrix* should be placed, on the one hand, near *Cingalina* Hebard, differing principally from that genus by having strongly defined lateral carinæ and less crassate hind femora, while, on the other hand, the affinities with *Mazarredia* are also apparent, but because of its small size rather misleading.

Key to the known Species of Hydrotetrix *Uvarov.*

1. Supplementary carinulæ on the dorsum of the pronotum prominently defined; vertex as broad as an eye or slightly broader; hind tarsi of normal length . . . **Marquesan species (2).**
Supplementary carinulæ poorly defined; vertex narrower to much narrower than an eye; hind tarsi normal or unusually long. **Tahitian species (3).**
2. Caudal apex of the pronotum broadly acute; lateral carinulæ on the fore margin of the pronotum convergent posteriorly; vertex about equal to the breadth of an eye . . . . . . *marquesana* **Hebard.**
Caudal apex of the pronotum bluntly obtuse; lateral carinulæ on the fore margin of the pronotum prominently raised and parallel in the male, or slightly divergent posteriorly in the female; vertex greater than the breadth of an eye . . . . *hivaoana*, **sp. n.**

3. Hind tarsi unusually long; vertex very narrow; surface smoothly granular, with dark brown angularly formed transverse fascia behind the shoulders of the pronotum........................ .... *cheesmanæ* Uvarov
Hind tarsi of normal length; vertex broader, but less than the width of an eye; surface of pronotum asperately granular . . . . *aspera* Uvarov.

Hydrotetrix hivaoana, sp. n.

Differs from the three known species by possessing a slightly broader vertex. Differs in particular from *cheesmanæ* by having the vertex much broader, supplementary carinulæ of the dorsum of the pronotum more prominent, and by broader more bluntly obtuse posterior apex of the pronotum, and by shorter hind tarsi; from *marquesana* by slightly broader vertex, more cristate lateral carinulæ on the fore margin of the prozona, and broader and more bluntly obtuse caudal apex of the pronotum. From *aspera*, to which it appears to be most closely related in form and shape, by slightly broader vertex and the more elevated carinulæ on the pronotum, especially that of the supplementary carinulæ on the caudal portions of the pronotum, and also by the less asperately granular surface.

Holotype.--1 ♂, Hivaoa, Marquesas, Dec. 2, 1922 (*E. H. Quayle*). Measurements in millimetres: body-length 7·0; pronotum 5·0; hind femur 4·3; antennæ 3·5. Type deposited in the collection of the University of Michigan Museum.

Size small, as typical for the genus. Vertex of head slightly greater than the width of an eye, prominently keeled, the transverse keels commencing near the centre of the inner eye-margins and curving downwards and inwards to the median carina, which is well defined on the front half of the vertex. Bi-impressed areas lie one on either side of the median carina, with deepest portions adjacent to the transverse keels. Frontal costa moderately arcuate, the costa sulcate, with the keels gradually diverging downwards from a point of bifurcation just below the transverse ridge. Paired ocelli centrally placed between the eyes; antennæ situated about centrally on a line with the lower eye-margins, thirteen-segmented and moderately long. The face is smooth, with sparsely placed minute granules, Pronotum tectate in form, with prominently raised median carinæ, which, viewed in profile, is gently arcuate and undulate; surface of pronotum smooth, sparsely and finely granulate. Lateral carinulæ on the fore margin of the prozona parallel and strongly raised; lateral carinæ running from the region of the middle sulcus to the caudal apex and strongly angled at the shoulders. Supplementary humeral carinulæ short and well defined, with an additional pair of long supplementary carinulæ near the apex that are strongly convergent posteriorly. Lateral lobes shallow, with the posterior angle truncately rounded. Fore femora with one upper and two lower keels and an outer middle keel, just below the middle. Middle femora with one upper and two lower keels, the outer lower undulate, and with two carinæ on the outer paginal face. Hind femora moderately crassate, their apices slightly exceeding the tip of the subgenital plate. Metatarsal joint about one and a half times the length of the third joint, and with a widely spaced tridentate keel below.

Allotype.—1 ♀, same data as the type, and deposited in the same collection. Measurements in millimetres: body-length 7·5; pronotum 5·5; hind femur 5·0; antennæ 4·0.

Size slightly larger than the holotype, but otherwise closely similar; carinulæ strongly raised, the lateral carinulæ on the fore margin of the prozona divergent posteriorly, supplementary carinulæ longer than in the type, that in the caudal portion of the pronotum well defined and strongly convergent posteriorly. Ovipositor short, with the upper and lower keels of the valvulæ minutely dentate.

Paratypes.—2♂♂, 1 nymph, same data as type. Measurements: body-length 7·2–7·4; pronotum 4·8–5·0; hind femora 4·3–4·5; antennæ 3·7. One paratype in the Tinkham collection.

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V.—*A Note on the Synonymy of Three Species of Fossil Crocodile of de Blainville.* By W. E. Swinton, Ph.D., F.R.S.E., Geological Department, British Museum (Natural History).

Many years ago Sherborn (1898) published the correct dates of publication of the various parts of de Blainville's 'Osteographie,' and in a note on the Museum copy of the work and an addition to his own paper Sherborn has pointed out that the 'Explication des planches,' published after the author's death, was issued in September 1855. There can be no doubt of this date, and although the fourth volume, in which the 'Explication' occurs, bears on its titlepage the comprehensive dates 1839–64, many authorities have consistently given the date 1835 to the species established in the 'Explication des planches.' As a result some errors in nomenclature and confusion in the synonymy of interesting forms have arisen and have been duly repeated in paper after paper.

De Blainville indicated three new species of fossil crocodile in the 'Explication'—*Crocodilus depressifrons*, *C. temporalis*, and, the most important of them, *C. macrorhynchus*.

Crocodilus depressifrons stands as a specific name, but with the date 1855 and not 1835 as given by Kuhn (1936) in his recent systematic survey. It is interesting to note that its synonym, *C. cœlorhinus* Pomel (1847), actually predates it, but the name is a nomen nudum.

The second species, *C. temporalis*, has long disappeared as a name in use, since it is antedated by its "synonym" *Mosellæsaurus rostrominor* Monard (1846), and both are in any case synonyms of the earlier established *Pelagosaurus typus* of Bronn (1841).

The third species, *C. macrorhynchus*, Upper Cretaceous of Mont Aimé (Marne), France, calls for much closer attention. Kuhn (1936) gives its date of publication again as 1835, Lydekker (1888) as "before 1848," and both place *C. isorhynchus* Pomel (1847) in its synonymy. Actually *C. isorhynchus*, which is quite adequately described, predates *C. macrorhynchus* by eight years, and must stand. Gervais (1859), however, did not realize this when he transferred the species to the genus *Gavialis*. Leidy (1865) transferred it to the genus *Thoracosaurus*, and it is generally referred to in current literature as *Thoracosaurus macrorhynchus* (Blainville). This obviously must be altered to the correct designation *Thoracosaurus isorhynchus* (Pomel).

Crocodilus macrorhynchus Bl., although predated as a species by *C. isorhynchus*, was actually predated as an identical name by over twenty years, for in 1834 Harlan established the name *Crocodilus macrorhyncus* for some bones from the Cretaceous of New Jersey that he had described many years earlier but without affixing a name to them (Harlan, 1824). These same remains were also described by Morton (1829, 1830), who still referred to them as bones of "The Crocodile." In 1832 von Meyer applied the name *Crocodilus harlani* to the bones described in Harlan's early paper, but this has been overlooked by many. Harlan published the name as *C. macrorhyncus* in part 1 of the first volume of the 'Transactions of the Geological Society of Pennsylvania' in 1834, and the part was reissued in the complete volume i. published in 1835. This has caused a certain confusion as to the date of publication. Nearly all the subsequent writers have misquoted the name as *C. macrorhynchus*, and it occurs quite frequently in American literature. In 1849 Agassiz created the genus *Bottosaurus* for *Crocodilus harlani* Meyer. Although they are now almost as far apart systematically as they are in geographical origin, some confusion between the species often exists, particularly as they are both mentioned, without cross reference, on adjacent pages of an important paper by Leidy (1865, pp. 11, 12).

The systematic position and synonymy of the two species may be given as :—

Family **Alligatoridæ.**

Bottosaurus harlani (Meyer).

Syn. *Crocodilus harlani* Meyer, 1832.
Crocodilus macrorhyncus Harlan, 1834, non Blv.
"The Crocodile," Morton, 1829, 1830.
"Extinct Species of Crocodile," Harlan, 1824.

Family **Tomistomidæ.**

Thoracosaurus isorhynchus (Pomel).

Syn. *Crocodilus isorhynchus* Pomel, 1847.
Crocodilus macrorhynchus Blainville, 1855, non Harlan.

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VI.—*Notes on Polychæta from the Coast of Western Canada.*—II. Syllidæ.

By E. and C. BERKELEY, Pacific Biological Station, Nanaimo, B.C.

INTRODUCTION.

Prior to 1923 no Syllidæ had been recorded from western Canadian waters. A list of fifteen species taken in the district of Nanaimo, B.C., published by one of us in that year (Berkeley, 1923, p. 205), included several forms previously described from points on the west coast of North America both south and north of British Columbia, together with some new to the coast and others new to science.

Study of material collected during the intervening years makes it necessary to comment on some of the species previously recorded, to extend some of their distributions, and to add three species previously described from California (*Syllis heterochæta*, *Odontosyllis phosphorea*, and *Autolytus varius*), six new to the west coast of North America (*Syllis sclerolæma*, *Sphærosyllis pirifera*, *Sphærosyllis hystrix*, *Exogone gemmifera*, *Exogone* *verrugera*, and *Autolytus aurantiacus*), and four new to science (*Syllis spenceri*, *Syllis pulchra*, *Syllis harti*, and *Exogone heterochæta*)

The types of the new species are in the authors' collection, and co-types, when available, will be deposited in the British Museum.

Syllis pulchra, sp. n.

This species is clearly characterized by the dark chocolate-brown dorsum and strongly contrasting ivory-white tentacles, tentacular cirri, and dorsal cirri. The colour of the dorsum is retained in varying degree in preserved specimens.

The type-, and largest, specimen is 30 mm. long and 1·5 mm. wide over the setæ. The prostomium is wider than long and more or less rectangular. There are two pairs of large eyes, the anterior pair slightly farther apart than the posterior pair, but the anterior and posterior eyes on either side close together. The tentacles are short; the lateral ones, which are not much longer than the united length of the prostomium and palps, are situated very near to the anterior margin of the prostomium. The median tentacle is about half as long again as the lateral ones and is between the posterior pair of eyes, almost on the posterior margin of the prostomium. Immediately behind it is a small heavily pigmented papilla. The palps are large, well separated, and curled longitudinally. The anterior edge of the peristomium has a median projection and two lateral concavities (fig. 1).

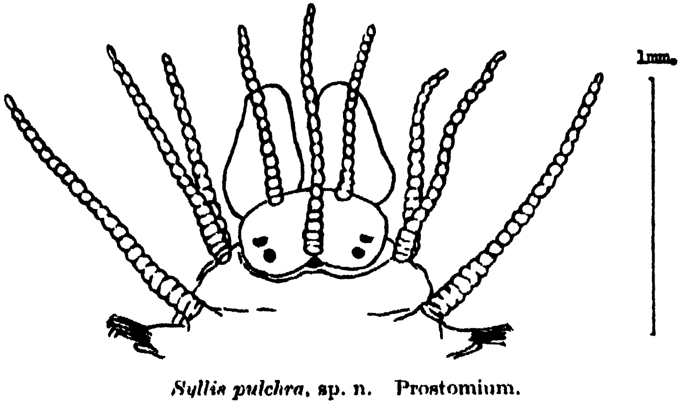
The tentacular cirri are short relative to the dorsal cirri. The latter are borne alternately well up on the dorsum and at the base of the foot. They are strongly articulated and alternately longer and shorter. The longer ones have from 50 to 70 articles, but even these, when contracted, barely reach across the dorsum. The basal articles are compressed and the apical ones are elongated and their diameter decreases gradually from base to tip. The gizzard extends to about the twenty-fourth setiger. The setæ are all compound and of one kind, with unidentate blades, very like those of *S. vittata* Grube, except in the last few segments, in which a simple spine also occurs.

In the bud, which is attached to the type and to one or two other specimens, the parapodium has a dorsal aciculum and a tuft of rudimentary swimming-bristles in the dorsal ramus.

If the coloration of this species is disregarded it approximates to *S. vittata* Grube, but it differs in the position of the eyes and tentacles and in the shape and number of articles in, and the insertion of, the dorsal cirri.

The type collected at False Narrows. Some smaller specimens at Coffin Island, Ladysmith Harbour, and dredged between Jesse Island and Five Fingers. All in the Nanaimo district.

Fig. 1.



Syllis pulchra, sp. n. Prostomium.

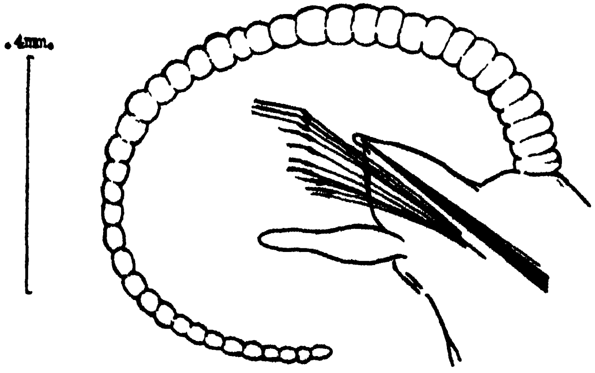
Syllis harti, sp. n.

This species is known from two specimens. The first was dredged at the head of Princess Louise Inlet, on the mainland coast of B.C., by Dr. J. F. L. Hart in about 25 fathoms, and the second by her brother, Mr. E. G. Hart, off Nootka Light, on the west coast of Vancouver Island, in about 45 fathoms.

We are indebted to Mr. Hart for most of the specimens recorded from the west coast of Vancouver Island in this paper, which he collected during the cruise of the Canadian hydrographical survey boat 'Wm. J. Stewart' in that region in 1935.

The type of the species is the specimen collected by Mr. Hart. The body is long and slender and consists of about 90 segments. It is 28 mm. long and about 1 mm. wide as preserved. The prostomium is very short and more than twice as wide as long. There are four small black eyes, the anterior pair considerably farther apart than the posterior. The palps extend well beyond the prostomium, are divergent, and are attached to one another only at the extreme base. The tentacles extend well beyond the palps; the median one is inserted between the posterior eyes, which are quite close to it, and the laterals on the anterior border of the prostomium.

Fig. 2.



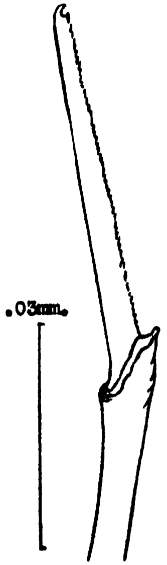
Syllis harti, sp. n. Parapodium.

The tentacles, tentacular cirri, and the dorsal cirri in the anterior few segments are approximately the same length. Farther back the dorsal cirri are definitely alternate in length and the longer ones may be about twice as long as the greatest width of the body. All the appendages are strongly moniliform and, in the median region, the longer dorsal cirri have 30 to 40 articles and the shorter 20 to 30. The proboscis is armed with a single anterior tooth. The ventral cirrus is the most outstanding character of this species. It is smooth and cylindrical, is inserted towards the tip of the foot, and projects well beyond it, in some cases almost as far as the ends of the setæ (fig. 2). The anal cirri are unusually long and tapering.

The setæ have all rather long blades, particularly the most dorsal ones in each bundle, which resemble those in the same position in the foot of *S. alternata* Moore, but have even longer blades. This character and the alternately long and short dorsal cirri are points of similarity between *S. harti* and *S. alternata*, but the two species are readily differentiated by the greater length of the dorsal cirri relative to the width of the body, the longer ventral cirri, and the greater length of the blades of the ventral setæ throughout the body, in *S. harti*.

The preserved specimens are uncoloured.

Fig. 3.



Syllis alternata Moore. Dorsal seta from anterior region.

Syllis alternata Moore.

Moore, 1908, p. 323 ; Berkeley, 1923, p. 206.

This species resembles *S. variegata* Grube, and the numerous species which have been placed in synonymy with it (see Fauvel, 1923, p. 262) in many respects. It differs from all of them, so far as can be determined by the descriptions available to us, in the nature of the most dorsal setæ in the anterior part of the body. These have slender shafts with slightly enlarged, finely toothed ends and extremely long, finely fringed, slender blades (fig. 3). Moore gives an approximate description of these, but does not figure them. Their presence seems to render the synonymy of *S. alternata* with *S. variegata* suggested by Monro (1933, p. 29) very doubtful.

The palps are fused at the base, as Moore figures them. This, and the presence of the long-bladed setæ, suggest that the form would be more correctly placed in the genus *Pionosyllis*, but the very definitely articulated antennæ and dorsal cirri would negative this classification. This anomaly is not without parallel in other species, and it seems that the degree of fusion of the palps and the articulation of the cirri cannot be linked together as a basis of generic differentiation, as is usually attempted.

This species has not been taken in the Vancouver Island region since 1919.

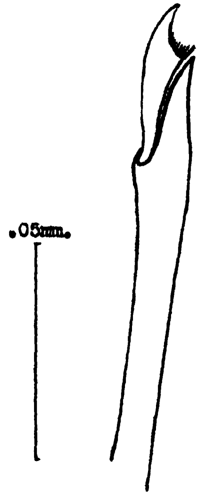
Syllis spenceri, sp. n.

A number of specimens of this species were collected in 1925 by Prof. G. J. Spencer at Departure Bay. In his notes he mentions finding them "in masses." The species has not been found since. It is readily recognized by the markings of the dorsum, which remain quite distinct in the preserved specimens. The ground-colour is cream, but this is overlaid with fine brown spots disposed in such a way as to leave a circular or oval area free from spots in the centre of each segment. On the first few segments these clear areas coalesce, forming a broad median band. The appendages are all cream-coloured.

The body, consisting of 110 to 120 segments, measures about 30 mm. in length, 2 mm. in width. It is of uniform width throughout, except at the extremities. The prostomium is about twice as wide as long. There are four eyes of uniform size arranged in a trapeze. The palps are rather short and broad and they are fused for about half their length. The tentacles project well beyond the palps. The median tentacle, which is a trifle longer than the laterals, is inserted between, or slightly behind, the posterior eyes. The proboscis is straight and is armed with a single anterior tooth. The gizzard extends to the fourteenth or fifteenth segment. The tentacles, tentacular cirri, and dorsal cirri are all strongly moniliform and do not differ greatly in length. They are not more than one-third the width of the body and consist of 10 to 20 articles.

The majority of the setæ have the type of shaft and short blades common in the genus, but in the most dorsal two or three in each bundle, particularly in the mddle of the body, the end of the shaft is very long and oblique and the articulating base of the blade corresponds (fig. 4). In all the setæ the free edges of the blades are coarsely hairy and they terminate in unidentate hooks.

Fig. 4.



Syllis spenceri, sp. n. Dorsal seta from median region.

All the specimens collected were budding, and it is probable that their occurrence in quantity at one spot is associated with reproduction.

This species affords another instance, like that of *S. alternata* Moore (*v. supra*), in which generic classification would differ according as the condition of fusion of the palps or of articulation of the cirri is taken as a basis of division.

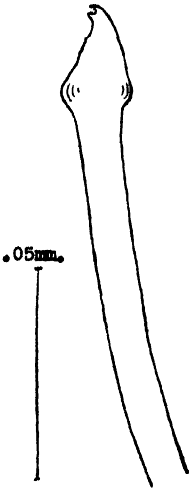
Syllis sclerolæma Ehlers.

Ehlers, 1901, p. 86; Monro, 1930, p. 102, 1936, p. 125.

This species, originally described by Ehlers from the Magellan region, has not previously been recorded from the west coast of North America. The specimens from Vancouver Island differ in a few minor particulars from the descriptions given by Ehlers and by Monro. The largest one is about 35 mm. long as preserved.

The palps are almost semicircular in outline and are hollowed on the ventral surface; when contracted laterally they have the conical form described by Ehlers.

Fig. 5.



Syllis sclerolæma Ehlers. Seta from large specimen.

The dorsal cirri tend to be alternately longer and shorter; the longest counted had 40 articles. The tentacles and tentacular cirri are rather more slender than the dorsal cirri and have fewer articulations than the longest of these. All our specimens have only two pairs of eyes. The lobes of the parapodia are practically equal in length. The setæ in the smaller specimens correspond exactly with the figures given by Ehlers and by Monro, but in the largest the articulation between the shaft and the blade has entirely disappeared and the seta has the appearance shown in the figure (fig. 5).

The animals are a pale pink colour in life, with white tentacles and cirri. In a large number of individuals the most posterior region of the body is coloured a bright red from the ova within, but no evidence of stolonization has been observed. Most of the colour is lost in preservation.

The species is common in the sponge which coats the shells of *Pecten hindsi*, dredged in 30 to 50 fathoms in Northumberland Channel in the Nanaimo region. It also occurs free-living in that locality and in about 8 fathoms at Gabriola Pass in the same vicinity. It has also been collected at low-tide mark at Loure Creek, Nuchatlitz Inlet, on the west coast of Vancouver Island.

Syllis elongata (Johnson).

Johnson, 1901, p. 403 ; Moore, 1909 *a*, p. 236 ; Berkeley, 1923, p. 206.

The distribution of this species is extended to the west coast of Vancouver Island.

The blades of the setæ vary in length in each foot throughout the body. Johnson's figure (pl. vi. fig. 70) represents a more ventral one fairly closely, but dorsally the blades are twice as long as figured. The blades of these setæ are very frequently missing and the shafts which remain terminate in such a way as to resemble the ypsiloid setæ characteristic of *S. gracilis* Grube and *S. longissima* Gravier. We have, however, failed to find any true ypsiloid setæ in many specimens examined. For this reason we are not in agreement with the suggestion of both Moore (1909 *a*) and Monro (1933) that *S. elongata* resembles *S. gracilis*, nor with that of the latter author that it may be a synonym of *S. longissima*.

Collected at low-tide mark at False Narrows and Gabriola Reef, in the Nanaimo region, and at Wreck Bay and Loure Creek, Nuchatlitz Inlet, on the west coast of Vancouver Island.

Syllis armillaris (Müller).

Fauvel, 1923, p. 264 ; Berkeley, 1923, p. 206.

The distribution of this species is extended to the west coast of Vancouver Island, where it was collected at low-tide mark at Bajo Point.

Syllis (*Ehlersia*) *heterochæta* Moore.

Moore, 1909 *b*, p. 322.

This species was originally described from a single specimen from San Nicolas Island, California, and Treadwell (1914 *a*) includes it, but with some reservations which render the identification doubtful, in his list of the polychætes in the collection of the University of California. The latter specimens were collected at Bolinas Bay, near San Francisco. There are no other records of its occurrence. The distribution is now extended to the west coast of Vancouver Island, where it was taken off Ferrer Point in about 23 fathoms.

Monro (1933) suggests that this species is synonymous with *S.* (*Ehlersia*) *cornuta* Rathke. We cannot agree. The two species have many points in common, notably the presence in both of three pairs of eyes, but the long-ended setæ which characterize the subgenus *Ehlersia* differ materially. In *S. cornuta* the blades are curved and have bidentate tips ; in *S. heterochæta* they are quite straight and have slightly knobbed ends, as Moore figures them (pl. xv. fig. 4 *b*).

Trypanosyllis gemmipara Johnson.

Johnson, 1901, p. 405 ; Berkeley, 1923, p. 207.

The distribution of this species is extended to the west coast of Vancouver Island. It was collected at low tide at the mouth of Esperanza Inlet.

Odontosyllis phosphorea Moore.

Moore, 1909 *b*, p. 327 ; Berkeley, 1923, p. 207 (var. *nanaimoensis*).

A variety of this species, taken in both the atokous and epitokous forms, was described from the Nanaimo region in 1923. The true species, as described by Moore, has since been found both in this region and on the west coast of Vancouver Island, but in the atokous form only. Collected at False Narrows, Nanaimo region, and at Ucluelet, west coast of Vancouver Island.

Eusyllis assimilis Marenzeller.

Fauvel, 1923, p. 294 ; Berkeley, 1923, p. 206 (*Pionosyllis lamelligera*).

This is the species recorded from the Nanaimo district in 1923 as *Pionosyllis lamelligera*. Further study of the material and of another specimen collected more recently in the original locality has convinced us that the former identification was erroneous.

The opening of the pharynx has the interrupted denticulated rim characteristic of *E. assimilis*, but the denticulations are heavier than they are figured by Fauvel. The pharynx has a very large conical tooth. All the setæ of about the first ten segments have moderately long blades. In the median region the more dorsal ones are short-bladed and the more ventral ones long-bladed. At the posterior end of the body they are again more or less uniform in type and all short-bladed. A simple capillary dorsal seta and a simple, rather heavy, bidentate, ventral one also occur in each bundle in the posterior region. Throughout the body the blades of the setæ are very coarsely bidentate.

Collected at False Narrows, Nanaimo region.

Sphærosyllis pirifera Claparède.

Fauvel, 1923, p. 301.

A number of specimens agreeing closely with the description given by Fauvel and others of this species were collected amongst bryozoa and small algæ at Loure Creek, Nuchatlitz Inlet, on the west coast of Vancouver Island. It has also been dredged in Northumberland Channel, in the Nanaimo region, in 30 to 50 fathoms.

Sphærosyllis hystrix Claparède.

Fauvel, 1923, p. 301.

Several specimens corresponding more closely with this species than with *Sph. pirifera* (v. supra) were taken together with the latter.

The main point of difference is the presence of glandular pits containing bundles of minute rods on each segment, beginning with the fourth setiger. The close resemblance of the two forms in other respects, and their occurrence together, suggests that the presence or absence of these glands may indicate no more than two phases of one species.

It is probable that the specimens recorded from Horsewell Point, in the Nanaimo district, in 1923, under the name *Sphærosyllis* sp., belong here, but the original material has been lost, and the form has not been collected since in this locality.

No species of *Sphærosyllis* has previously been reported from the west coast of North America.

Exogone gemmifera (Pagenstecher).

Fauvel, 1923, p. 305

This species is common at Horsewell Point and at False Narrows, both in the Nanaimo district, at low-tide mark, amongst bryozoa and small algæ The specimens agree closely with Fauvel's description. Some of them have long swimming-bristles.

Exogone verrugera (Claparède).

Fauvel, 1923, p. 307, Claparède, 1868, p 213.

A number of specimens of this species were collected amongst bryozoa and small algæ at Loure Creek, Nuchatlitz Inlet, on the west coast of Vancouver Island. They agree with Fauvel's description and figures in all respects except the compound setæ and the heavy simple ventral setæ which occur in the posterior region of the body. These correspond very closely with the figures given by Claparède (pl xii. fig. 3 *a*).

Exogone lourei, sp. n.

This species is known from two specimens, one from the east coast and one from the west coast of Vancouver Island. The type, the former and larger specimen, is 8 mm. long as preserved and has 45 setigers. The palps are fused into a bluntly conical process with a longitudinal ventral median groove. There are two pairs of eyes, the anterior pair large and with lenses, the posterior pair close behind them and without lenses. Only the median tentacle can be made out with certainty. This is fusiform and is only a little longer than the joint diameters of the eyes in the type, somewhat longer than this in the smaller specimen. There is no distinct division between the prostomium and peristomium, and no tentacular cirri can be made out. The dorsal and ventral cirri are lanceolate and well developed and are present on all the parapodia.

There are five to nine setæ in each parapodium. In the anterior region the most dorsal seta in each bundle is

Fig. 6.

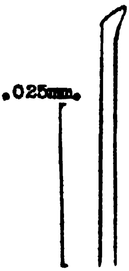


Fig. 7.

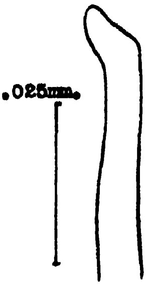


Fig. 8.

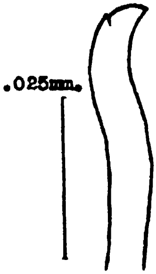


Fig. 9.

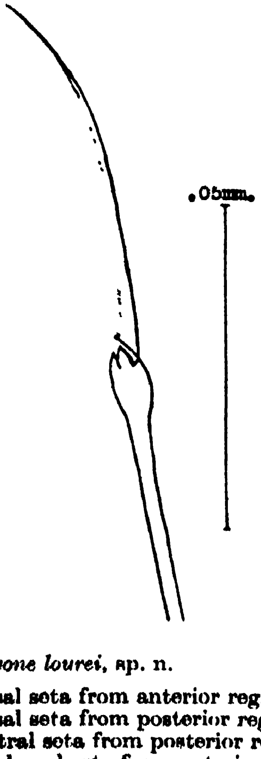
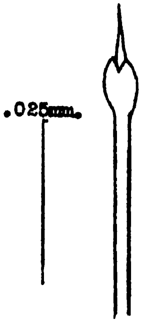


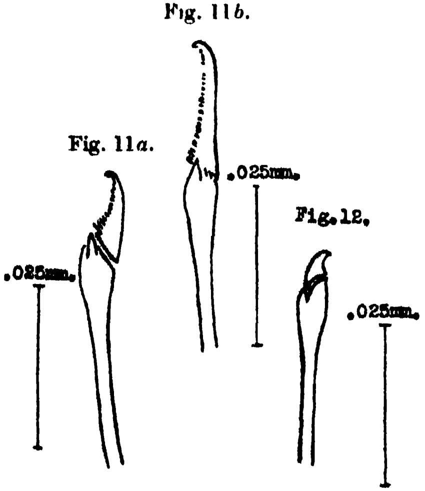
Fig. 10.



Exogone lourei, sp. n.

Fig. 6.—Simple dorsal seta from anterior region.
Fig. 7.—Simple dorsal seta from posterior region.
Fig. 8.—Simple ventral seta from posterior region.
Fig. 9.—Compound dorsal seta from anterior region.
Fig. 10.—Compound dorsal seta from posterior region.

simple and has an obliquely truncated end (fig. 6). This becomes increasingly bent at the tip in more posterior parapodia until, in the most posterior segments, it is heavily hooked (fig. 7). In all except the last few segments, which have, in addition to the others, one or two heavy simple curved hooks (fig. 8) ventrally in each bundle, all the remainder of the setæ are compound. The most dorsal one or two have very long, finely dentulate, curved, slender blades in the anterior region of the body (fig. 9), shorter and straighter ones in the posterior region (fig. 10). The others are of the typical *syllis* form and also vary with the region of the body. Anteriorly they have rather long blades with simple hooked terminations (figs. 11 *a* and 11 *b*), posteriorly the blades are very short and the ends of the shafts are somewhat expanded (fig. 12). The acicula have blunt rounded ends and do not pierce the ends of the parapodia. There are two rather long anal cirri.



Exogone lourei, sp. n.

Figs 11 *a* & *b*.—Compound ventral seta from anterior region.
Fig. 12.—Compound ventral seta from posterior region.

It is conceivable that this species is identical with *E. heterosetosa* McIntosh, which is mainly characterized by the presence of spatulate setæ. If the setæ described as spatulate actually correspond with the dorsal compound setæ in the posterior region in the present species (fig. 10), which does not seem impossible if the cleft at the termination of the shaft were overlooked, McIntosh's description and figure of the setæ of the twenty-first parapodium of *E. heterosetosa* (McIntosh, 1885, p. 205, pl. xxxiv. A, fig. 11) would correspond very nearly with what is found in one from the posterior region in the present species. The long swimming-bristles which were present in McIntosh's specimen and are absent in ours would indicate no more than different stages of maturity. McIntosh gives no description of the setæ in the anterior parapodia of *E. heterosetosa* whereby this possible identity could be determined with certainty.

Collected at False Narrows, in the Nanaimo region, and at Loure Creek, Nuchatlitz Inlet, on the west coast of Vancouver Island.

No species of *Exogone* has been recorded previously from the west coast of North America.

Autolytus magnus Berkeley, *Polybostrichus* phase.

Berkeley, 1923, p. 210.

The original description of this species was based upon a single individual in the *Sacconereis* phase collected in Departure Bay in February 1921. Only one specimen has been taken since that time. This was captured in the tow-net at the type-locality and at the same time of year, and was a representative of the *Polybostrichus* phase. The identity was established chiefly by the size and by the similarity of the shape of the foot to that of the *Sacconereis* phase.

The *Polybostrichus* consists of the usual three regions. The anterior region has 14 setigers, the median 43 with swimming-bristles, and the posterior 46. The length of the specimen as preserved is 38 mm., and the greatest width, excluding the setæ, is 4 mm.

Autolytus varius Treadwell, *Sacconereis* phase.

Treadwell, 1914 *b*, p. 237 ; 1922, p. 137.

This is another large *Autolytus*, but it does not reach the size of *A. magnus*. The longest specimens of *A. varius* recorded by Treadwell were 30 mm. in length, our own specimens are not as long as this; the corresponding phase of *A. magnus* is 40 mm. long.

The two species are best differentiated by the shape of the parapodia. In *A. varius* the two lobes are very nearly equal in length and the aciculum reaches to the tip; in *A. magnus* the dorsal lobe is definitely longer than the ventral one and the aciculum is shorter than the parapodium (*cf.* Berkeley, 1923, pl. i. figs. 3 and 4; and Treadwell, 1914 *b*, figs. 4 & 5). There is also a greater tendency to uniformity in length between the tentacles, tentacular cirri, and the dorsal cirri in the anterior region of the body in the *Sacconereis* phase of *A. varius* than in that of *A. magnus*, but differentiation on this basis is not easy, since the character is not very constant in *A. varius* and the tentacles and cirri are readily broken.

Collected in plankton at Dodd's Narrows, in the Nanaimo district, and at Berry Point, Burrard Inlet, on the mainland coast.

Autolytus aurantiacus (Claparède).

Fauvel, 1923, p. 313.

Two atokous specimens are ascribed to this species with some hesitation because their markings do not accord with the available descriptions. As preserved the general body-colour is a pale orange-brown and there are three longitudinal lines of dark pigment running the whole length of the dorsum, but more marked in the anterior region. The median line is broader but much less dense than the lateral ones. In all other respects the specimens agree closely with the descriptions of *A. aurantiacus* except that the pharynx, though sinuous, does not appear to describe a complete loop.

Dredged in Departure Bay in 10 to 15 fathoms.

Autolytus prismaticus (Fabricius).

Chamberlin, 1920, p. 12; Berkeley, 1923, p. 209.

The nurse-stock of this species has been collected at low-tide mark, amongst bryozoa and small algæ, at Loure Creek, Nuchatlitz Inlet, on the west coast of Vancouver Island, and both sexual forms have been taken in the plankton in Departure Bay and off Berry Point, Burrard Inlet, on the mainland coast.

The previously known range of distribution is thus extended.

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VII.—*On a Collection of* Gryllidæ *and* Tridactylidæ *from Sierra Leone*. By Dr. L. CHOPARD.

ALTHOUGH the African fauna of Gryllidæ and Tridactylidæ is fairly well known as a whole, it is rather surprising that, so far, very few species have been collected in Sierra Leone. Mr. E. Hargreaves' collection, communicated to me by Dr. B. P. Uvarov, brings up to fifty-two the number of species known from that region; but it can certainly not be considered yet as sufficiently representative of the fauna of the country. Many species which inhabit Guinea and which have not yet been recorded from

Sierra Leone will most probably be found there. As a matter of fact, the fauna of tropical Africa is widely spread in general. It is not at all an uncommon fact to note species which are found in all the intertropical zone, from West to East. Again, such species as *Gymnogryllus lucens* seem to extend widely towards South Africa.

It is therefore rather difficult to indicate the peculiar characters of the Sierra Leone fauna, which is, on the whole, purely Ethiopian. A few species, however, seem to be limited to the region, and some of them deserve special mention. Such is the case with *Eugryllodes transversus*, with a strongly reduced ovipositor and a sandy coloration which, curiously enough, resembles desertic species; *Pteronemobius hargreavesi*, which is closely related to Indian species of the genus; *Pteronemobius amplipennis*, which shows very peculiar characters and is quite different from all the forms already known; lastly, *Paragryllus limosus*, which is the only representative in the Old World of a genus very characteristic of the fauna of Central America. This insect exhibits all the characters of the American species, both in the male elytral venation and in very special secondary sexual characters, consisting in the presece of a swollen apical spur of the hind tibiæ in the male.

Finally, I shall call attention to the *Gryllulus* species of the *burdigalensis* group. In conformity with Saussure's views, it has been long considered that this group contained only a few very variable species. When studying the male genitalia of a number of specimens from different regions I have become convinced that, on the contrary, there exist quite a number of forms which are perfectly different as species and the geographical distribution of which seems much less wide than it had been supposed.

Types of the new species and most of the other specimens will be deposited in the British Museum (Natural History).

Family **Gryllidæ**.

Gryllotalpa africana Beauv., 1805.

This widely distributed species is not represented in the collection, but it has been recorded from Sierra Leone by Walker.

Gymnogryllus lucens Walk., 1869.

Described from Sierra Leone, this species is found in the whole tropical Africa; it is shining black, with lateral lobes of the pronotum yellowish in front.

Gymnogryllus chabanaudi Chop., 1925.

Njala, iii. 1930, 1 ♀.

The female of this species has not been described; the shape of the ovipositor (fig. 1) is very remarkable; the stem is thick, with parallel margins up to the base of the apical valves, which are, on the contrary, very narrow, acute at apex.

Gryllus bimaculatus De Geer, 1773.

Gryllus morio F., 1781 (*Gryllus atratus* Walk.).
Gryllulus lineaticeps Walk., 1869 (=*quadristrigatus* Sauss.).

Described from Sierra Leone by Walker. The male genitalia form a wide lamellar median piece (fig. 2).

Gryllulus leucostomus Serv., 1839.

This species has been recorded by Walker under the name of *guttatus*.

Gryllulus posticus Walk., 1869.

This species, also described from Sierra Leone, belongs to the *leucostomus* group; *G. gracilipes* Sauss. is probably a synonym of it.

Gryllulus obscuripennis, sp. n.

Types: Côte d'Ivoire: Dimbroko, 1 ♂, 1 ♀ (coll. Chopard); Njala, 1 ♂ (*E. Hargreaves*, paratype).

♂.—Medium size; coloration rather uniform blackish brown, with rufous legs and a yellowish humeral band on the elytra. Head blackish, shining, without any ornament. Scutello-frontal suture very convex, reaching the inferior level of the antennary sockets.

Pronotum transverse, wholly blackish brown, very weakly narrowing in front, with anterior margin a little concave. Abdomen and cerci brown. Genitalia in the shape of a long lamellar plate (fig. 3, *a*).

Legs rather short, rufous with a blackish pubescence. Posterior femora stout; tibiæ armed with five internal, six external spines.

Elytra dark brown, with yellowish humeral edge; speculum a little wider than long, approximatively in the shape of a parallelopiped with somewhat rounded angles, divided by a transverse vein a little beyond the middle; *Di* straight, long; *Co* feebly curved, the first one rather close to the diagonal, to which it is united by a few small veinlets; four oblique veins, the first of which is strongly sinuated; apical field rather large, presenting five sectors and a regular reticulation of narrow lengthened meshes; lateral field black, with very regular and close veins, five in number, besides two branches of the *Sc*. Wings caudate.

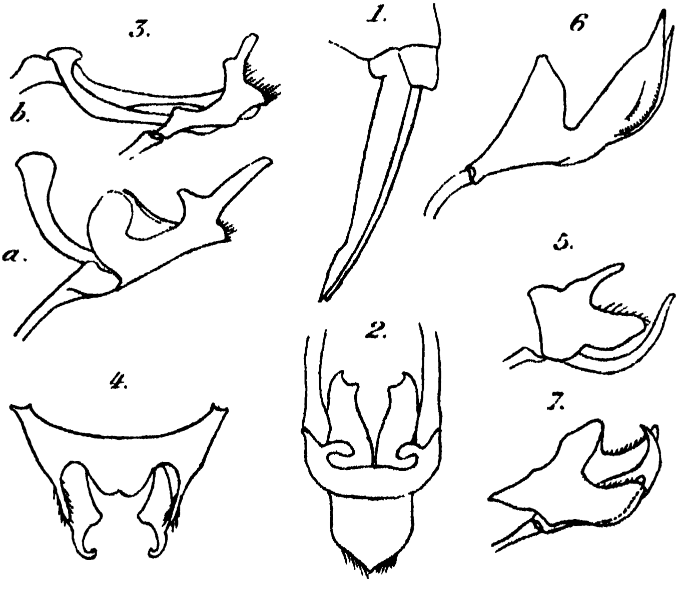


Fig. 1.—*Gymnogryllus chabanaudi* Chop., ovipositor.
Fig. 2.—Genitalia of male of *Gryllulus lineaticeps* Walk., dorsal view.
Fig. 3.—Genitalia of male of *Gryllulus obscuripennis*, sp. n., lateral view: *a*, type-specimen from Ivory Coast; *b*, specimen from Sierra Leone.
Fig. 4.—Genitalia of male of *Gryllulus similis*, sp. n., dorsal view.
Fig. 5.—Ditto, lateral view.
Fig. 6.—Genitalia of male of *Gryllulus xanthoneuroides* Chop., lateral view.
Fig. 7.—Genitalia of male of *Eugryllodes transversus*, sp. n., lateral view.

♀ (allotype).—General shape and coloration of the male.

Ovipositor as long as the posterior femora, with acute apical valves. Elytra with oblique, regularly spaced veins, in the number of four free ones and four branches of the *Cu*; transverse veinlets numerous, rather regular, forming somewhat elongate areolæ; lateral field with veins still more close than in the male. Wings caudate.

Length of body 12 mm.; length with wings 28 mm.; post. fem. ·8 mm.; elytra 7 mm.; ovipositor 8 mm.

This species looks rather like a dark variety of *G. burdigalensis* with entirely black head, but the male differs from it in the presence of four oblique veins, and the female has a longer and especially more acute ovipositor. Besides, the genitalia of male are quite different in both species. The specimen from Sierra Leone is quite similar to the type, but the genitalia, although presenting the same general shape, are shorter (fig. 3, *a*, *b*); the difference between the two forms does not seem to be of specific importance.

Gryllulus similis, sp. n.

Type: Njala, 17. iv. 1930, 1 ♂.

A rather small species, presenting the general habitus of *burdigalensis*. Head adorned with five yellowish bands on the occiput and a transverse interocellar stripe of the same colour; face brown, with a yellow spot round the ocellus. Scutello-frontal suture rather low but subangular.

Pronotum transverse, punctuated and spotted with brown. Legs as in *burdigalensis*. Genitalia quite different from those in the latter species, the superior part being divided into three lobes, the median somewhat bilobate; inferior part curved (figs. 4, 5).

Elytra nearly as long as abdomen; speculum lozenge-shaped, with infero-external margin shorter than the others; two oblique veins; apical field with four sectors; veins of the lateral field close; *Sc* bearing two branches. Wings caudate.

Length of body 11 mm.; length with wings 17·5 mm.; post. fem. 8 mm.; elytra 7 mm.

Besides the shape of genitalia this species differs from *burdigalensis* in the low scutello-frontal suture; this suture is also lower than in *G. bei-bienkoi* Chop., in which species it reaches nearly the middle of antennal socket.

Gryllulus xanthoneuroides Chop., 1933.

The specimens of this species are quite similar to those from East Africa; the shape of the male genitalia is very characteristic (fig. 6).

Eugryllodes transversus, sp. n.

Types: Njala, i. 1931, 1 ♂; 21. xi. 1930. 1 ♀.

♂.—Size medium; yellowish brown, a little shining, finely pubescent. Head adorned on the cranium with four indefinite yellow bands and a scarcely visible interocellar line; frontal rostrum very wide. Face yellow; scutello-frontal suture angulate but low, scarcely reaching the inferior level of antennary sockets. Antennæ and palpi yellowish; last joint of maxillary palpi a little darkened, long, slightly enlarged at apex.

Pronotum strongly transverse, with anterior margin slightly concave, posterior one straight; disk feebly convex, brownish, with rather wide yellowish bands along the median line and both anterior and posterior margins; lateral lobes yellowish, with brown superior part and inferior margin.

Legs yellowish, a little mottled with brown. Anterior tibiæ bearing a large external tympanum. Posterior femora stout, a little striated with brown at their external face; tibiæ armed with five spines on each margin; the two large internal spurs equal in length; metatarsi compressed, feebly dilated, armed with 6–7 denticles on each margin.

Elytra rather wide, extending to the apex of abdomen, with *Gryllus*-like venation; speculum strongly transverse, angulate in front, rounded backwards, non-divided; *Di* rather long, a little curved towards the first chord; *Co*1 and *Co*2 much curved, parallel; *Co*3 thick, feebly sinuated; the first chord united to the speculum by a rather long vein; three oblique veins; apical field rather long, presenting six sectors and square reticulation; lateral field almost transparent, with a brown superior band, showing four feebly distant veins and two branches of the *Sc*. Wings caudate.

♀ (allotype).—Similar to the male, with a little more distinct pattern on the head and pronotum. Abdomen brownish, pubescent. Ovipositor completely atrophied and concealed under the subgenital plate. Elytra as long as abdomen, yellowish brown, with somewhat irregular oblique veins; two *Ax* short, united at apex and ending towards the middle of the internal margin; *An* ending also on the internal margin a little after the middle; *Cu* coming in the apical angle; *R* with two branches rather widely separated; transverse veinlets numerous, forming narrow and rather irregular areolæ; lateral field with inferior margin strongly ascending backwards, with plain veins. Wings caudate.

Length of body 12·5 mm.; length with wings 19 mm.; post. fem. 8 mm.; elytra 7·5 mm.

This very peculiar species has the general shape of a *Gryllulus* with very wide pronotum, but its rather special coloration reminds one of the genus *Eugryllodes*. Besides, the female with completely aborted ovipositor also resembles *Eugryllodes pomeroyi* Chop. It does not seem, however, possible to consider it as a macropterous form of this last species, which has in the female sex squamiform, quite lateral elytra.

Miogryllus senegalensis Chop., 1934.

Gryllopsis notabilis Walk., 1869.

This species, described from Sierra Leone by Walker, belongs to the *scenicus* group, which is very well characterized by the small head and the pronotum narrowing in front.

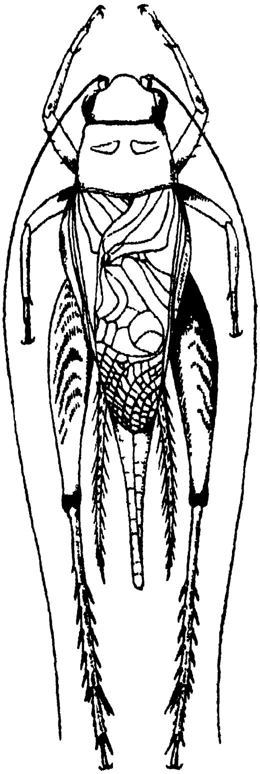
Gryllopsis microlyra, sp. n. (Fig. 8.)

Type: Njala, 17. iv. 1930, 1 ♂.

A rather large species, dark chestnut-brown above, yellow beneath. Head big, globular, the cranium chestnut-brown, shining; frontal rostrum very wide, rounded. Face wholly yellow in its inferior part from the anterior ocellus. Antennæ brown, with the two first joints yellow. Palpi yellow; the three last joints of the maxillary palpi subequal in length, fifth a little enlarged at apex. Eyes rounded, feebly projecting; lateral ocelli rather big, yellow; anterior one very small.

Pronotum slightly narrowing in front, with straight anterior margin, posteroir margin feebly sinuated; disk convex, dark chestnut-brown, somewhat velvety; pyriform depressions narrow, tinged with rufous; lateral lobes yellow, with straight inferior margin, anterior angle right, posterior one rounded. Abdomen brown above, yellowish beneath; subgenital plate strongly notched at apex. Genitalia (fig. 9) large, the superior part double, ending in a small hook, inferior part bifid.

Fig. 8.



Gryllopsis microlyra, sp. n., male.

Legs short, yellowish, a little mottled with brown. Anterior tibiæ perforated with a rather large oval tympanum at external face and a very small internal one. Posterior femora stout, a little striated with brown at external face; tibiæ armed with seven external, six internal rather long slender spines; apical spurs rather long, the two large internal ones equal in length. Metatarsi long, rather slender, very feebly compressed, armed with six external, four internal denticles.

Elytra extending to the apex of abdomen, rounded at apex; dorsal field dark brown, with a very small, nearly round speculum, divided about the middle by an arcuated vein; *Di* short, very distant from the first chord; chords very short and arcuated, the first one united to the mirror by a long vein; three oblique veins, emerging from the same point and diverging; apical field long, presenting seven sectors and numerous transverse veinlets, forming a rather regular reticulation, with narrow alveolæ; lateral field very large, yellowish, with somewhat undulated scarce veins, of which five free ones and four branches of the *Sc*; this last vein is also strongly undulated. Wings caudate.

Length of body 18 mm.; length with wings 27 mm.; post. fem. 12·5 mm.; elytra 13 mm.

This species is well characterized by its coloration and by the elytral venation.

Scapsipedus uncinatus, sp. n.

Scapsipedus marginatus Afz. & Brann., 1804.

Types: Njala, 17. iv. 1930, 1 ♂; Njala, iii. 1930, 1 ♀.

General appearance of a big *Gryllulus burdigalensis*. Head adorned with six yellow lines on the occiput and a narrow interocellar band. Face feebly flattened, brown down to the middle of the clypeus, yellow beneath; scutello-frontal suture low, angulate in the middle; mandibles long, yellow; cheeks a little ridged beneath the eyes. Palpi yellow; fifth joint of the maxillary palpi triangular, somewhat obliquely truncated at apex.

Pronotum strongly transverse, with feebly concave anterior margin, straight posterior one; disk slightly convex, testaceous marbled with brown; lateral lobes with inferior margin slightly ascending backwards, narrowly blackish, their superior part brown, the inferior one yellow. Abdomen brown above, yellowish beneath. Genitalia presenting the same general shape as those of *Gryllulus similis*, the median lobe undivided and wide at apex; inferior part strongly curved (fig. 10).

Legs yellowish, feebly mottled with brown. Posterior femora a little striated at external face; tibiæ armed with five spines on each margin, the base of the spines brownish.

Elytra extending to the apex of abdomen; speculum wider than long, lozenge-shaped, divided beneath the middle by a curved vein; two oblique veins; apical field rather long, with three sectors; lateral field nearly transparent, with a brown band in its superior part; veins moderately distant, the *Sc* bearing two branches. Wings caudate.

♀ (allotype).—Similar to the male, with the head quite *Gryllulus*-like. Elytra a little shorter than the body,

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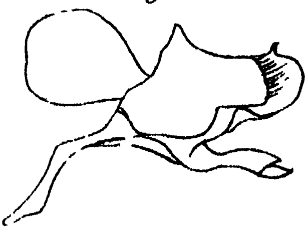

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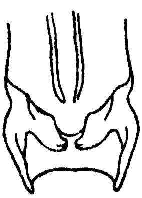

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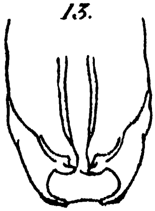

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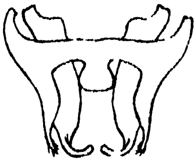

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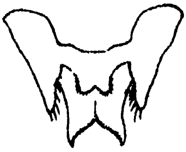

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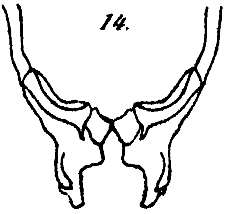


Fig. 9.—Genitalia of male of *Gryllopsis microlyra*, sp. n., lateral view.
Fig. 10.—Genitalia of male of *Scapsipedus uncinatus*, sp. n., dorsal view.
Fig. 11.—Ditto of *Scapsipedus simillimus*, sp. n.
Fig. 12.—Genitalia of male of *Pteronemobius hargreavesi*, sp. n., dorsal view.
Fig. 13.—Ditto of *Pteronemobius fascipes* Walk.
Fig. 14.—Genitalia of male of *Anaxipha ornata* Chop., ventral view.

with strong, brown, somewhat oblique veins; *R* bearing four branches; lateral field with veins a little more close than in the male; *Sc* with two branches. Wings caudate. Ovipositor rather short, with apical valves rather acute and not so wide as in *G. burdigalensis*.

Length of body, ♂ 14 mm., ♀ 12·5 mm.; length with wings, ♂ 19·5 mm., ♀ 20 mm.; post. fem., ♂ 9·5 mm.,

♀ 8·5 mm.; elytra, ♂ 9·5 mm., ♀ 6 mm.; ovipositor, ♀, 8 mm.

This species is close to *Sc. neavei* Sjöst., but smaller. Some males are smaller than the type (11·5 mm.), with the head presenting almost the exact shape of that of a *Gryllulus*, with short mandibles, the face being only feebly flattened; the shape of the genitalia, however, leaves no doubt of the identity of these minor males. The female looks very much like *Gryllulus bei-bienkoi* Chop., but the scutello-frontal suture is lower. A micropterous form exists in this species.

Scapsipedus simillimus, sp. n.

Type: Njala, 10. iv. 1932, 1 ♂.

This species is so similar to the preceding that a complete description would be useless. At first sight it differs from it only in very small characters, the elytra being shorter with very reduced apical field, the speculum a little more transverse; wings short; but the genitalia (fig. 11) are so completely different from those of *S. uncinatus* that the specific validity of this form is beyond question. As in the former species, the superior part is divided into three lobes, which are shorter and the median one notched at apex, but the inferior part, instead of being composed of a pair of hooked processes, forms a single piece, feebly carinated above and rather strongly emarginated at apex.

Length of body 13·5 mm.; post. fem. ·9 mm.; elytra 6·5 mm.

Clearidas nigriceps Stål, 1876.

Njala, 14. v. 1930, 1 ♂; v. 1934, 1 ♀.

Pteronemobius æthiops Sauss., 1877.

Pteronemobius unicolor Chop., 1934.

Pteronemobius maculosus Sauss., 1899.

Pteronemobius niveipalpis Sjöst., 1909.

Pteronemobius minutus Bol., 1910.

All these species of the genus *Pteronemobius* are widely distributed in tropical Africa.

Pteronemobius acrobatus Sauss., 1877.

Described from Sierra Leone, this species is also widely spread in Africa, extending in the south to Mozambique and in the north to South Algeria.

Pteronemobius hargreavesi, sp. n.

Types : Njala (*E. Hargreaves*, iii. 1932), 1 ♂ ; 14. v. 1932, 1 ♀ (light trap).

Testaceous varied with brown, the legs adorned with wide brown bands. Head wider than pronotum in front ; cranium light testaceous, with four short brown bands on the occiput ; frontal rostrum a little wider than the first antennal joint, provided with two rows of long bristles. Face brown, shiny ; cheeks brown. Antennæ light brown, with first two joints darker. Maxillary palpi with fourth joint much shorter than third, fifth large, triangular, rather weakly enlarged at apex ; the three first joints dark brown, the two last yellowish. Eyes rounded ; ocelli rather big, forming a triangle.

Pronotum transverse, rather strongly narrowing in front, with straight anterior margin, very slightly convex posterior one ; disk feebly convex, varied with brown and testaceous and provided with long bristles which are inserted on a brown spot ; lateral lobes very dark brown. Abdomen brown above, yellowish beneath. Cerci brown with a yellowish ring before the middle.

Anterior femora brown except the base, which is yellowish ; tibiæ almost entirely brownish, perforated with an oval tympanum at external face ; metatarsi brown, with a wide yellow ring about the middle ; second and third joints brown. Median femora half brown, half yellowish ; tibiæ brown, with two yellowish rings. Posterior femora rather narrow and long, yellowish, with three brown spots, one about the anterior fourth, occupying only half of the width of external face, the second one after the middle, forming a complete ring, the third at apex. Tibiæ brown, adorned with three yellowish rings, the spines brown, with yellow base and apex ; three spines on each margin in the female, three external, four internal, the first of which is tuberculiform in the male. Inferior apical spurs short, unequal in length, the two large internal ones long. Metatarsi yellowish, with a brown band in the middle.

Elytra brownish ; speculum small, nearly triangular, divided posteriorly into two cells, of which the internal very small, occupying scarcely half the internal margin ; *Di* and chords long, nearly straight ; lateral field brown, with four parallel veins. Wings long, caudate.

♀ (allotype).—Elytra brown, with rather strong, somewhat irregular veins, five in number ; transverse veinlets scarce, yellowish. Wings caudate. Ovipositor long, straight, with strongly denticulated apical valves, the teeth directed backwards.

Length of body 5·5 mm. ; length with wings 9·5 mm. ; post. fem. 4·5 mm. ; elytra 3·5 mm. ; ovipositor 3·2 mm.

All the specimens are macropterous ; they present small variations in the elytral venation. The general coloration is very much like that of *P. fascipes* Walk., from India, from which the present species differs in the somewhat longer posterior femora and in the rather different shape of the genitalia (figs. 12 & 13). It is the second known African species of this Oriental group, the other being *P. occidentalis* Chop., from Morocco, which looks very much like *P. hargreavesi* but is of a much lighter general colour, resembling the Oriental *P. csikii* Bol.

Pteronemobius amplipennis, sp. n. (Fig. 15.)

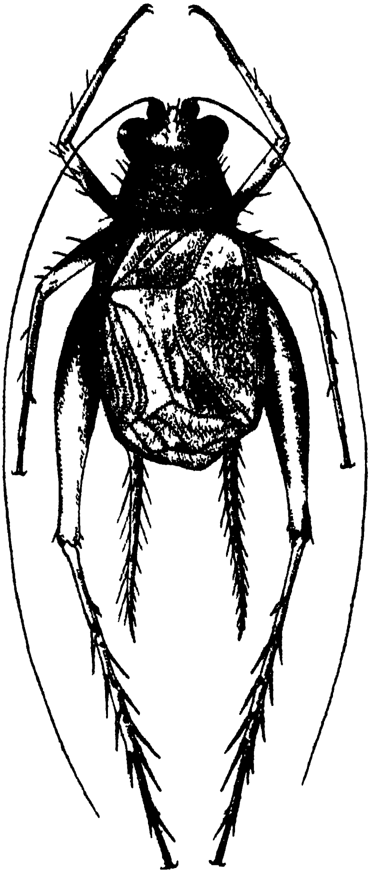
Type : Njala, 27. ix. 1932, 1 ♂.

Small, blackish brown, shiny. Head wide, brown, with strongly sloping forehead ; frontal rostrum wide. Face brown. Antennæ brown at base, followed by a rather long whitish part, and again brown from the middle to the apex. Palpi brown ; fourth joint of the maxillary palpi shorter than third, fifth very large, in the shape of a rather wide triangle.

Pronotum transverse, a little narrowing in front, with anterior and posterior margins straight, provided with bristles ; disk a little convex, uniformly blackish brown, presenting a light pubescence and long sparse bristles ; lateral lobes of the same colour as the disk, with feebly expanded inferior margin. Abdomen brownish ; subgenital plate short and wide. Cerci brownish.

Legs rufous, pubescent. Anterior tibiæ perforated at external face with a large oval tympanum. Posterior femora rather stout, unicolorous. Tibiæ bearing three external and four internal spines, the first of which is tuberculiform; these spines are brown, with yellow base and apex; inferior apical spurs quite unequal in length, the internal one much the longer; the two large internal spurs very long. Metatarsi long, brown.

Fig 15.



Pteronemobius amplipennis, sp. n., male.

Elytra blackish, shiny, wide, rounded at apex; speculum strongly transverse, presenting a large cell extending all along the internal margin; space between the oblique vein and *Cu* very wide; *Di* and *Ob* long and nearly straight; apical field almost inexistent and without veins; lateral field high, blackish, with five straight, very regular veins. Wings abortive.

Length of body 5 mm.; post. fem. 4 mm.; elytra 3·5 mm.

This species is very remarkable, and quite different from other African *Pteronemobius* both by its coloration and by its wide elytra, with somewhat convex margins.

Trigonidium cicindeloides Ramb. 1839 (=*Trigonidium atrum* Walk.).

Trigonidium guineense Sauss., 1877.

This species is probably merely the macropterous form of the preceding.

Rhicnogryllus fuscus Chop., 1918.

Njala, 27. xii. 1927, 1 ♀.

Anaxipha dimidiatipes Bol., 1910.

Njala, 14. xi. 1928, 1 ♂; vii. 1934, 1 ♀.

Anaxipha gilva Karsch, 1893.

Anaxipha maxima Chop., 1918.

Njala, 11. iv. 1932, 1 ♀.

Anaxipha ornata Chop., 1937.

This species, described from East Africa, presents usually a very distinct pattern of the head, which is adorned above with four brown lines; it is rather close to *A. contaminata* Karsch, in which the head shows a transverse brown band. The genitalia (fig. 14) are rather short, very feebly incurved, and finely denticulated.

Cyrtoxipha villosa Chop., 1934.

Njala, 22. iii. 1934, 1 ♂.

Anacyrtoxipha albotibialis La Baume, 1911.

Njala, 1. iv. 1932, 1 ♂; 1. vi. 1932, 1 ♂.

The male of this species was not known; it is one of the prettiest Trigonidiinæ, which shows a combination of greyish, brown, and pure white colours. The elytra are greyish, very pubescent, looking narrower posteriorly in consequence of the deviation of the median vein, which comes somewhat on the dorsal field. Venation very peculiar and difficult to elucidate; *Ax*1 plain; *Ax*2 united at base to *Ax*3, which is itself joined to *An*; *R* and *Rs* simple; apex of elytron occupied by a few large very irregular cells; *M* white as well as the small veins which join it to *R*; lateral field brown just as a small ovoid space at the apex of *M*; three veins in the lateral field. Wings lengthily caudate, very pubescent.

Length of body 6·5 mm.; length with wings 9·5 mm.

Trigonidomorpha pallipes, sp. n (Fig. 16.)

Types: Njala, 8-14. v. 1932, 1 ♂ (light trap); 17. iv. 1925, 1 ♀, at light.

♂.—Small, narrow, brownish, with yellow legs, a little shiny. Head a little wider than pronotum in front; forehead sloping and feebly flattened, finely pubescent; frontal rostrum a little narrower than first antennal joint, yellow at apex. Face short and wide, brownish, with a small yellow, somewhat callous band extending from the inferior angle of the eye to the clypeus. Antennæ yellowish, with first two joints brown. Palpi yellow; fourth joint of the maxillary palpi much shorter than third, fifth large, triangular, straightly truncated at apex.

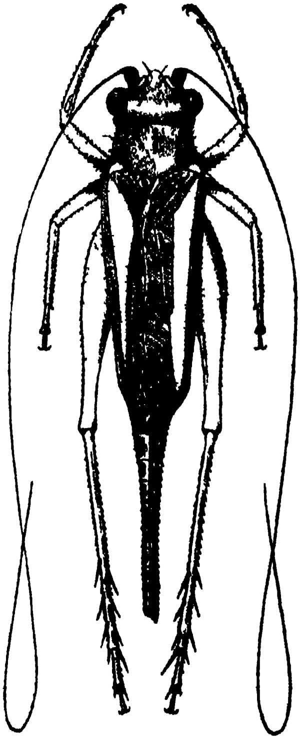
Pronotum transverse, a little narrowing in front, with feebly convex anterior margin, posterior one a little sinuated; disk nearly flat, a little shiny, light brown, with a yellowish spot on each shoulder near the posterior angle; pubescence rather scarce and mixed with a few long brown bristles; lateral lobes high, with straight inferior margin, anterior angle rounded, their superior part of the same colour as the disk, the inferior part yellowish. Abdomen brown above, yellowish beneath; subgenital plate long, narrowing towards the apex, with a small projection in the middle of the posterior margin. Cerci yellow.

Legs yellow, pubescent. Anterior tibiæ perforated on both sides. Posterior femora rather narrow, unicolorous, with a row of about ten bristles along the internal inferior margin. Tibiæ with yellow spines, the largest internal spur scarcely longer than the spines.

Elytra brownish, with rather strong, yellowish veins and a rather wide light band on the humeral edge;

venation irregular, with rather neat anal vein and a suggestion of a mirror, formed by the diagonal vein, which is divided in the middle; the apical part of the elytron is occupied by two large and three smaller cells; chords straight, the second one extending to the apex of elytron; oblique vein also nearly straight and ending

Fig 16.



Trigonidomorpha pallipes, sp n., male.

in the angle of the mirror; lateral field brown, with four rather regular veins, of which the second one is very short. Wings caudate, brown, a little pubescent.

♀ (allotype).—Very similar to the male in its general shape and colour, but with more regular, almost longitudinal elytral venation; *Ax*1 and *Ax*2 united about the apical fourth, the first one joined to *An* a little farther ; *Cu* divided quite near the apex ; transverse veinlets weak and not very numerous, forming long areolæ. The part of the left elytron which is covered is transparent, with rather irregular venation. Ovipositor rather long, feebly curved, with very long apical valves, presenting smooth, parallel margins in their two basal thirds, the apex strongly denticulated.

Length of body 6 mm. ; length with wings 9·5 mm. ; post fem. 4·5 mm. ; elytra 5 mm. ; ovipositor 3 mm.

This species is quite distinct both by its coloration and by the elytral venation.

Cycloptiloides chatanayi Chop., 1918.

Njala, 19. iv. 1930, 1 ♀.

Acanthoplistus acutus Sauss., 1877.

Njala, 17. iv. 1930, 1 ♂.

Pentacentrus tenellus Karsch, 1893.

Gryllomimus chopardi Ebner, 1935 ; Chopard, 1936, Ann. & Mag. Nat. Hist. (10) xvii. p. 541.

Njala, iii. 1932, 7 ♀.

Paragryllus limosus Walk., 1871.

Described from Sierra Leone, this remarkable species has never been found again.

Homœogryllus tessellatus Serv., 1839.

Phæophilacris funesta Walk., 1871.

Known from the type-specimen only.

Xenogryllus eneopteroides Bol., 1890.

Njala, 27. v. 1928, 1 ♂ ; 21. vii. 1932, 1 ♀.

Euscyrtus bivittatus Guér., 1844.

Family **Tridactylidæ.**

Tridactylus variegatus Latr., 1809.

Tridactylus madecassus Sauss., 1896,

Tridactylus digitatus Coq., 1804.

Tridactylus minor Chop., 1920.
Pokuna, 1 ♂.

Tridactylus crassicornis Chop., 1920.
Takpoina, 3 ♂.

Tridactylus flavidorsum, sp. n.

Type ; Njala, ix. 1934, 1 ♂.

Small ; brown, with a wide yellowish band on the back ; feebly shiny. Forehead very wide, yellowish ; face brown, rather coarsely punctured. Lateral ocelli big, rounded, the anterior one smaller. Antennæ composed of ten joints, the first three yellowish, shining, the following ones brown, very pubescent ; third joint long, fourth to seventh very short, eighth to tenth long. Palpi yellow, with brown last joint.

Pronotum wide, rather convex, yellowish above, brown on the sides ; inferior margin of the lateral lobes strongly notched, anterior angle straight, posterior angle a little produced, provided with a bristle. Abdomen brownish above, yellowish beneath ; subgenital plate wide, straightly truncated ; last tergite deeply furrowed, with ciliated margins ; supero-anal valve brown, truncated at apex ; inferior valve presenting a small triangular rufous prominence. Cerci with first joint brown, second yellow ; process of the anal valves yellow.

Anterior legs yellow ; internal inferior margin of the femora provided with a dozen flattened hairs ; tibiæ wide, a little furrowed at internal face, armed with four spurs. Median femora yellow, with a brown spot near the apex ; tibiæ much dilated with parallel margins, varied with yellow and brown. Posterior femora dark brown, with yellow base and extremity. Tibiæ yellowish, weakly denticulated at base and bearing three internal, four external lamellæ ; inferior apical spurs very long and narrow ; lamellæ and spurs yellow. Metatarsus a little shorter than the small spurs, in the shape of a narrow ovoid.

Elytra brown, with an oval yellow spot near the suture ; lateral field yellowish from the subcostal vein, which is strongly sinuated. Wings very long, whitish, a little iridescent, feebly darkened towards the apex and along the superior margin.

Length of body 4·5 mm.

This species looks very much like *T. madecassus*, but is much smaller and the base of elytra is finely shagreened instead of being punctured. The coloration seems characteristic, but it is not certain that it is not variable.

VIII.—*A new Species of* Cooperia *(Nematoda) from Cattle and Sheep. By* H. A. BAYLIS, M.A., D.Sc., Department of Zoology, British Museum (Natural History).

THE species here described was, so far as the writer is aware, first found in the Federated Malay States by Mr. G. B. Purvis, F.R.C.V.S. Among a collection of helminths received in 1933 from Mr. Purvis there were two sets of specimens which the writer provisionally determined as *Cooperia ? africana* Mönnig, 1932. One set had been collected from the small intestine of a calf at Seremban, F.M.S., in February 1933, the other from the small intestine of a sheep (imported from Australia) at Malacca in April 1932. In May 1937 some specimens of what appeared to be the same form were received from Dr. F. H. S. Roberts, of the Animal Health Station, Yeerongpilly, Queensland. These had been collected from the small intestine of cattle at Townsville, Queensland, in March 1937. Further specimens obtained from cattle at Clifton, Queensland, in June 1937, were received later from Dr. Roberts.

In every case, except the Seremban calf, the specimens sent consisted of males only. This was probably due to the difficulty of distinguishing the females of different species of *Cooperia* when, as is usually the case, they occur together.

As already stated, it was at first thought that the species might be identical with *C. africana*, a form described by Mönnig (1932, 1933) from the eland (*Taurotragus oryx*) in Kenya. Through the kindness of Dr. P. J. du Toit, Director of Veterinary Services, South Africa, the writer has now had the opportunity of examining one of Mönnig's three original male specimens of *C. africana*, and is satisfied that it represents a different species. The form from Malayan and Australian cattle and sheep is accordingly regarded as a new species, and the specimens from the calf at Seremban are designated as the types.

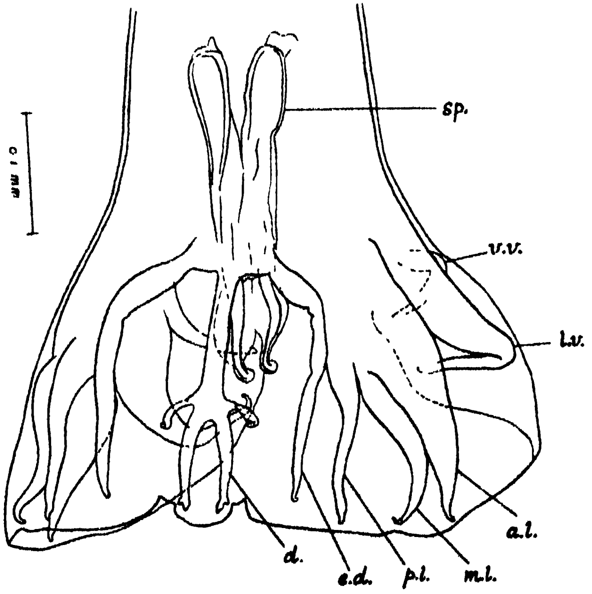
Cooperia spatulata, sp. n.

The male measures 6·3–7·5 mm. in length, the female 6·1–7·8 mm. The thickness of the body increases gradually, in the male, from the anterior end to the bursa. and in the female from the anterior end to the region of the vulva, where there is a pronounced swelling. The thickness of the male just in front of the bursa is about 0·16–0·21 mm., and in the middle region of the body about 0·1–0·13 mm. The maximum thickness of the female (just in front of the vulvar flap) is 0·17–0·24 mm., and the thickness in the middle region about 0·1–0·13 mm. There is a slight inflation of the cuticle of the head, measuring 0·036–0·04 mm. in diameter. The diameter of the head, without the cuticular inflation, is 0·028–0·03 mm. The cuticle of the body is raised into twelve transversely striated longitudinal ridges. The œsophagus measures 0·35–0·41 mm. in length in the male, and 0·4–0·44 mm. in the female. The nerve-ring is situated at 0·22–0·28 mm. from the anterior extremity. A pair of very small and inconspicuous cervical papillæ was seen in one male and in one female. In the former they were situated behind the posterior end of the œsophagus, at a distance of 0·425 mm. from the anterior extremity; in the latter in front of the end of the œsophagus, at 0·39 mm. from the head-end. An excretory pore was detected in one female at 0·3 mm. from the anterior end.

The bursa of the male (fig. 1) differs little from that of *C. punctata* (v. Linst.) or *C. africana* Mönnig (see Mönnig, 1933, fig. 21). The dorsal ray gives off, just before its bifurcation, a pair of lateral branches which have their terminations on the inner side of the bursa. There is a very slight swelling at the base of each of these branches, on its outer surface. The tips of the main branches are slightly notched and irregular, with an indication of a very small lateral branch. The antero-lateral ray is very stout and the latero-ventral ray the next stoutest.

The genital cone is of the form indicated in fig. 2. The portion of it which forms the posterior or dorsal lip of the cloacal aperture is supported by a chitinoid structure with a strong, posteriorly directed, conical process. On either side of this there is a papilla with a ventral termination and an elongate pulp. The anterior or ventral lip also contains an elongate, conical, papilla-like structure with a slightly swollen base. The spicules provide the most distinctive specific character. They are of the form indicated in figs. 1, 3, and 4. In its distal third each spicule carries a very pronounced semilunar ventral flange. This is part of the relatively solid chitinoid ventral wall of the spicule, and presents a narrow edge in ventral view, being much flattened laterally. Immediately in front of it there is a kind of pocket or recess,

Fig. 1.



Cooperia spatulata, sp. n.

Posterior end of male: dorsal view. *a.l.*, antero-lateral ray; *d.*, dorsal ray; *e.d.*, externo-dorsal ray; *l.v.*, latero-ventral ray; *m.l.*, medio-lateral ray; *p.l.*, postero-lateral ray; *sp.*, spicules; *v.v.*, ventro-ventral ray.

Fig. 2.

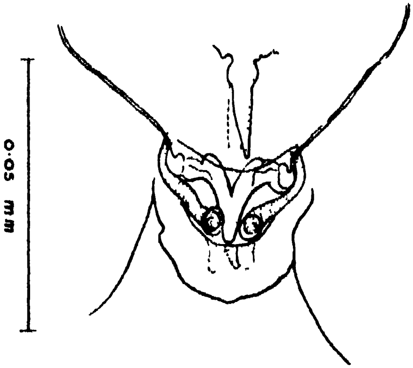


Fig. 3.

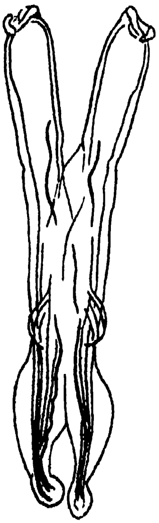


Fig. 4.

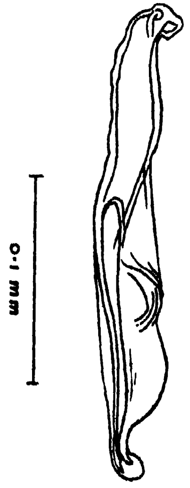


Fig. 5.

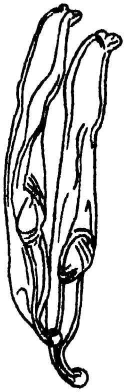
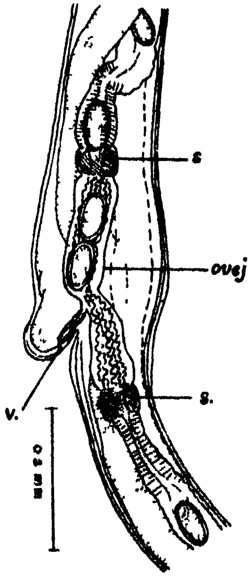


Fig. 2.—*Cooperia spatulata*, sp. n. Genital cone of male; ventral view.
Fig. 3.—Ditto. Spicules of male; ventral view.
Fig. 4.—Ditto. Right spicule of male, from right side.
Fig. 5.—*Cooperia africana* Mönnig. Spicules of co-type; latero-ventral view. (Drawn to the same scale as figs. 3 and 4.)

with concentrically wrinkled or striated walls. The distal portions of the spicules, in some views, appear to be invested with delicate membranous sheaths (fig. 3). In shape the spicules are very similar to those of *C. africana* (fig. 5). The ventral flange is, however, much more highly developed, while there appears to be a corresponding reduction of the membranous expansion on the dorsal side of the shaft in the same portion of the spicule. The size of the spicules is also considerably greater. In

Fig. 6.



Cooperia spatulata, sp. n.
Vulval region of female; lateral view. *ovej.*, ovejector; *s.*, *s.*, sphincters; *v.*, vulva.

C. africana, according to Mönnig, the spicules measure 0·191–0·206 mm. in length. In the co-type specimen examined by the writer the spicules measured 0·165 mm. and 0·17 mm. respectively. In *C. spatulata* the spicules vary in length between 0·23 mm. and 0·29 mm.

The tail of the female is 0·17–0·21 mm. long. The vulva is situated at a distance of 1·4–2·1 mm. from the posterior extremity. It opens on the posterior surface of a flap which projects from the ventral side of the body (fig. 6). At the point of origin of this flap the body is conspicuously swollen, while behind the flap its diameter is suddenly reduced. The combined length of the two ovejectors, including their sphincters, varies between 0·3 mm. and 0·55 mm. The eggs measure 0·068–0·082 mm. × 0·034–0·042 mm.

Schwartz (1928) included ten species in his key to the genus *Cooperia*. Since that time at least twelve more have been described, though some of them are probably synonyms. The present form appears to approach more closely to *C. africana* Mönnig than to any other known species, but may be distinguished from it by the shape and size of the spicules.

The type-specimens are in the British Museum (Natural History).

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IX.—*On a new Species of Serpulid Polychæte from the Shoreham Harbour Canal, Sussex.*

By C. C. A. MONRO, Department of Zoology, British Museum (Natural History).

MR. R. C. FISHER, of the Department of Scientific and Industrial Research, kindly submitted to me some small Serpulids sent to him by the Brighton, Hove, and Worthing Gas Company. These Serpulids grow in great quantity in Shoreham Harbour Canal, where they form an incrustation about an inch thick on pontoons, the bottom of boats, etc. The incrustations bear a strong superficial resemblance to *Salmacina*. Now the water in Shoreham Harbour Canal differs considerably in temperature from that of the English Channel. According to some figures very kindly supplied me by the management of the Brighton, Hove, and Worthing Gas Company the water temperatures taken in the canal on the 14th of September of this year at one foot below the surface two hours after high water at average neaps showed an average of 72·4° F., and on September 21st, 1937, at the highest spring tide of the year, 71° F., the temperature of the Channel water being given as 59° F. and 58° F. respectively. Similarly the temperatures six feet below the surface on September 23rd of this year showed an average of 70·5° F., that of the Channel water being given as 60° F.

The installation of new and more efficient lock-gates in 1932, and the discharge of large quantities of hot sea-water into the canal from the power-station of the Brighton Corporation Electricity Company, seem to have caused a gradual rise in temperature over the last three years, the average temperature of the water in December 1935 being given as 58° F., in October 1936 as 62° F., and, as already stated, in September of 1937 as 72·4° F. Salinity tests made on the 14th of October, 1937, revealed no difference between the canal water and that of the Channel.

The Serpulid is close to *Hydroides norvegica* Gunnerus, known from the Arctic to the Indian Ocean, and fairly common on the British coasts, but it presents certain features which, in my opinion, justify the establishment of a new species.

Genus HYDROIDES Gunnerus.

Hydroides incrustans, sp. n.

Occurrence.—Shoreham Harbour Canal, Sussex.

Description.— A small Serpulid measuring 5–10 mm. including the branchiæ by c. 0·5 mm. for about 40 chætigers, of which seven are thoracic.

The gills are variably banded with purple, red, or brown, and there is a purple patch on each side on the base of the branchial plumes on the inside. The paired branchial lobes each have nine branchiæ with naked filiform tips (fig. 1). There is a low, thick, oblique palmar membrane higher ventrally than dorsally. The operculum (fig. 2) is borne on a long rounded peduncle having neither radioles nor wings. It is funnel-shaped, with a slightly concave top divided into about twenty teeth, which may be blunt or pointed. From the centre of this cup there arises a short column surmounted by a crown of about twelve spines, each furnished with two pairs of lateral teeth. The operculum is more commonly on the left side, but sometimes on the right. On the opposite side there is a short club-shaped pseudoperculum. In a few examples the opercula are paired; in a number the distal crown of spines is absent and only the proximal cup is present. Between the bases of the opercular peduncles there is a thick rectangular process with a more or less straight anterior border. The mouth lies between a pair of small parallel lips. The collar is large, widely open dorsally, and ventrally reflexed. It is entire except at the sides, where it joins the thoracic membrane. There is a pair of eye-spots in the first segment. The thoracic membrane is wide and at its hinder border forms a kind of free collar on the ventral side.

Fig. 1.

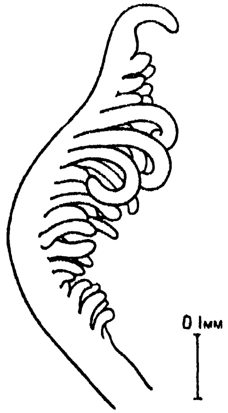
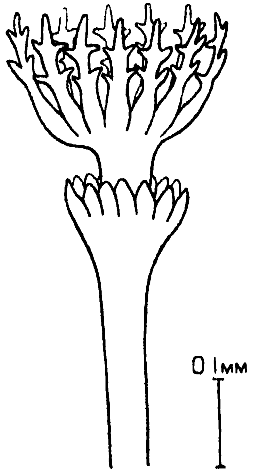


Fig. 2.



Hydroides incrustans, sp. n.
Fig. 1.—A single branchia.
Fig. 2.—Operculum.

The collar-bristles are remarkable. They are of two kinds, faintly serrated capillaries and bristles with hispid tips, a central emarginate smooth area, and below this a fin-like expansion covered with fine denticles and having at its most distal point a pair of teeth larger than the rest (fig. 3). The remaining thoracic bristles are simple lightly bordered blades (fig. 4). The thoracic uncini (fig. 5) are pectiniform, and have eight or nine more or less equal teeth above the inferior boss. In the anterior part of the abdomen each segment carries two or three trumpet-shaped bristles (fig. 6), and in the posterior part these are replaced by simple capillaries. The abdominal hooks (fig. 7) are very small and difficult to see. They appear to be similar in form and number of teeth to the thoracic hooks, but considerably smaller. The body ends in a pair of small lobes. The females are producing eggs about 40 μ in diameter.

The tube is white, sinuous, and very faintly transversely wrinkled, but there are no longitudinal ridges. They may reach a length of c. 45 mm.

They form dense polyp-like masses, standing out about an inch above the substratum.

Remarks.—This is either a new species or a juvenile neotenic form of *Hydroides norvegica*. The differences between the present form and a normal adult *H. norvegica* are these: the present form has a maximum length of about 10 mm. for c. 40 chætigers, and *H. norvegica* goes up to about 30 mm. for c. 100 chætigers. *H. norvegica* has 15–20 pairs of gills and the present form only nine. The collar-bristles are very different from those of *H. norvegica*, being typical of a young *Hydroides*. The hooks have nine teeth as against seven in *H. norvegica*, and their shape is rather different, for they do not show a marked difference in size between the basal tooth and the rest. The present form is reproducing itself actively, and I was informed locally that it has not been found outside the canal gates.

Fauvel (1911, p. 437, pl. xxi. figs. 55–58) describes some small *Hydroides* from Bouchir in the Persian Gulf. These have a length of 7–8 mm. and collar-bristles exactly like the present form. He attributes them to *H. norvegica*, and similarly Claparède (1870, p. 527, pl. xiv. fig. 4) describes an *Eupomatus trypanon* from the Gulf of Naples

Fig 3.

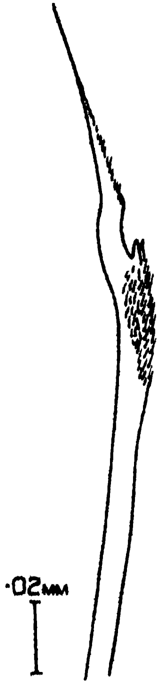


Fig 4.

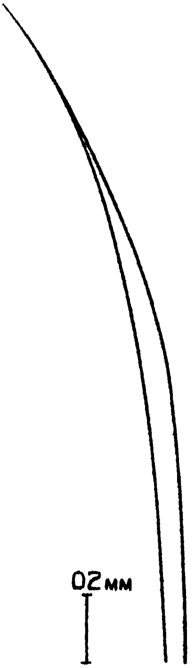


Fig 5.

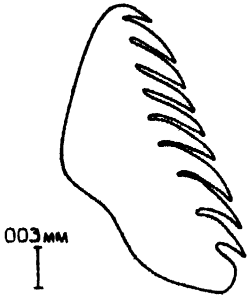


Fig. 6.

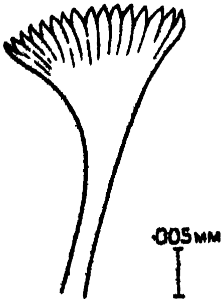
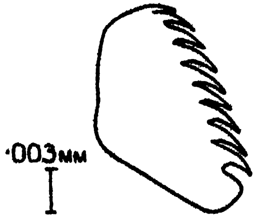


Fig. 7.



Hydroides incrustans, sp. n.

Fig. 3.—Collar-bristle.
Fig. 4.—Thoracic bristle.
Fig. 5.—Thoracic uncinus.
Fig. 6.—Abdominal trumpet-bristle.
Fig. 7.—Abdominal uncinus.

which is generally regarded as a young *H. norvegica.* In the latter the collar-bristles show a much later stage of development than those of the present form.

If this is a new species, and it is more convenient to treat it as such, it has probably been introduced on the keel of a ship from a warmer climate. An analogous case would be that of another small Serpulid, ***Mercierella enigmatica*** Fauvel, which was found almost simultaneously some years ago in the brackish water of the London Docks and of the canal at Caen, in Normandy. It has since appeared in a variety of brackish-water habitats in Europe and America, and is now thought to have originated in a brackish-water lake on the east coast of the Indian Peninsula.

On the other hand, it is quite possible that the high temperatures in the canal have had a selective effect on the rate of growth of the gonads of *H. norvegica*, and so produced a neotenic race, which reproduces itself but does not attain to normal development. This is a matter that experiment alone can decide. If the subjecting of specimens of this form to a gradual reduction in temperature resulted in the appearance of the normal *H. norvegica* the matter would be settled.

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X.—Crocidura samaritana *Bate*: *a Correction.*

By DOROTHEA M. A. BATE.

IN the September number of this Journal (p. 397) several species of mammals from the Wady el-Mughara Caves in Palestine were described as new. In October I received a letter from Dr. Glover M. Allen, of the Museum of Comparative Zoology, Harvard College, Cambridge, Mass., U.S.A., drawing my attention to the fact that the name given to one of these species, *Crocidura xanthippe*, had already been used. This specific name had been given by Dr. Wilfred H. Osgood to a Recent shrew from East Africa in 1910 (Publ. Field Museum Nat. Hist. (Zool.) vol. x. no. 3, p. 19).

The full account of the fossil fauna of the Wady Mughara Caves was then about to be published, but through the courtesy of Mr. Mulgan of the Clarendon Press I was able to have an erratum slip inserted in Part II. of 'The Stone Age of Mount Carmel,' Garrod and Bate, 1937. This slip reads in part as follows :—

> "For CROCIDURA XANTHIPPE Bate (preoccupied) read CROCIDURA SAMARITANA nom. nov."

The following will be the synonymy :—

Crocidura samaritana Bate.

Crocidura xanthippe Bate, 1937, Ann. & Mag. Nat. Hist. (10) xx. p. 398. (Name preoccupied.)
Crocidura samaritana, nom. nov., Bate, in Garrod and Bate, 1937, 'The Stone Age of Mount Carmel,' i. part ii. p. 139. Oxford.

XI.—*Descriptions and Records of Bees.*—CLXVI.

By T. D. A. COCKERELL, University of Colorado.

THE holotypes of new species and varieties described in this and all subsequent parts of this series will be found in the British Museum, unless the contrary is stated.

Apis mellifera L.

Morocco : Asni, August 1930 (*Cockerell, W. P. Cockerell, A. Mackie*) ; Ifrane (*A. Mackie*) ; Tangier, July 31 (*Cockerell*).

These are all typical *A. mellifera*, but one from Arround, 1900 m., in the Atlas Mts., Aug. 10 (*A. Mackie*), is var. *carnica* Pollmann.

Halictus ultraparvus, sp. n.

♂.—Length about 4 mm., anterior wing 2·7.

Black, with long-oval abdomen and very little pubescence, the face not conspicuously hairy, the thin hair on the postscutellum not hiding the surface ; broad apical band on clypeus, labrum, and mark on mandibles cream-colour ; tubercles black but shining, so that in some lights it is possible to imagine a pale spot; head approximately round seen from in front, but the clypeus projecting; front very densely and minutely punctured; antennæ stout, of moderate length, not moniliform, the scape short and black, the flagellum pale red, darker above; tegulæ pale testaceous, not punctured; mesothorax and scutellum polished, with very minute well-separated punctures; postscutellum large, plicatulate at base; area of metathorax a broad curved band, its length in middle not quite equal to that of postscutellum, its surface almost smooth, with very fine oblique striæ, and very short irregular plicæ at extreme base; posterior truncation rounded at sides and above, without sharp margins. Wings hyaline, stigma and nervures very pale, the stigma with a brown margin; first recurrent nervure joining second cubital cell near end. Front tibia testaceous in front, middle tibia with a light stripe going its whole length, hind tibia with the same, but seen from in front black, with each end light; tarsi very pale yellowish, apically becoming reddish, but not dark, front tarsi noticeably long. Abdomen shining, without hair-bands or spots, the suture between first and second tergites depressed.

Morocco: Asni, Aug. 1930 (*Alice Mackie*).

Halictus perminutus, sp. n.

♂.—So similar to the last that I had considered it identical, but it must be separated on account of the following characters:—Head broad-oval, clypeus more produced, labrum pale reddish; supraclypeal area brilliantly polished (dull in *H. ultraparvus*); flagellum black above, though pale red beneath; the polished mesothorax with no median groove; punctures of mesothorax and scutellum stronger; area of metathorax a little longer than postscutellum, with distinct parallel plicæ reaching about two-thirds of the way to apex; legs darker, the middle and hind tibiæ black, without the longitudinal light stripes. Tubercles black, not light-spotted as in *H. asnicus* Ckll., which has very long antennæ.

Morocco: Asni, Aug. 1930 (*Alice Mackie*).

These two very minute species will be recognized by their size, the dark tubercles but light spot on mandibles, and the flagellum red beneath. *H. minutulus* Schenck, which might seem allied by the tables, is much larger, with quite different antennæ. *H. brevicornis* Schenck, which has the flagellum red beneath, is also much larger. *H. glabriusculus* Mor. (*granulosus* Alfk.) resembles *H. perminutus*, differing by the brown nervures and white hair on face.

Halictus minutulus speculigerus, nom. nov.

Halictus minutulus speculiferus Cockerell, Amer. Mus. Novitates, 1937 (Siberia), nom. preocc.

Halictus (*Evylæus*) *tinitinensis*, sp. n.

♀.—Length about 5·5 mm., anterior wing about 4 mm.

Black, rather robust, with broad abdomen, the hind margins of the tergites narrowly and obscurely reddened; pubescence greyish white, not abundant, forming cuneiform patches at lateral bases of second and third tergites, but these are inconspicuous; head large, rather long oval or oblong, the clypeus projecting; flagellum obscurely brown beneath; mandibles rufescent subapically; clypeus shining, coarsely punctured; supraclypeal area elevated, highly polished in middle; front dull, narrowly shining along orbits; vertex shining; mesothorax dullish and densely punctured, with a strong median sulcus; scutellum shining on disc, with a slight median depression; postscutellum dull, not densely tomentose; area of metathorax rather short, with fine parallel plicæ, the apex thickened and shining, but not sharply margined; posterior truncation dullish, the sides distinctly margined only on lower part; mesopleura dull and densely punctured; tegulæ shining dark reddish brown. Wings strongly greyish, stigma dusky reddish, nervures pale; by transmitted light the stigma appears bright ferruginous. Legs black, with pale hair, light yellowish on inner side of hind basitarsi. Abdomen moderately shining, the first tergite highly polished. Microscopical characters: front excessively densely punctured, the intervals between the punctures crossed by fine lines; punctures of mesothorax on a minutely tessellate surface; tegulæ not punctured; first recurrent nervure almost meeting intercubitus; hind spur with five rather short spines; apical part of area of metathorax rugose, with a more or less reticulate effect; abdomen finely but very distinctly punctured, the apical parts of first two tergites well punctured, the apical part of third also punctured, but finely transversely lineolate at the junction of apical and basal parts.

Morocco; Tinitine, in the High Atlas, Aug. 10, 1930 (*Alice Mackie*).

Certainly close to *H. punctatissimus* Schenck, but the pubescence of the abdomen is different. It much resembles *H. intermedius* Schenck, but is easily distinguished by the longer head and duller mesothorax. The much larger elongate head at once separates it from *H. minutissimus* Kirby. *H. griseolus* Mor. (*dubitabilis* E. Saund.) is considerably smaller. *H. buccalis* Pérez has a different abdomen, with large white hair-patches on second and third tergites. In Blüthgen's table in Deutsch. Ent. Zeits. 1935, p. 115, this runs to *H. dernaensis* Blüthg., from Cyrenaica, differing by the lack of broad pallid margins to tergites.

Halictus villosulus perlautus, subsp. n.

♂ (type).—Wings very clear hyaline, stigma pale red with a dusky margin, nervures pale; scutellum with a strong median sulcus; area of metathorax strongly shining.

♀.—Wings and stigma more dusky; area of metathorax with a thickened shining margin; surface of abdomen minutely hairy.

Morocco: Asni (type-locality), one male, Aug. (*Cockerell*), one female (*W. P. Cockerell*); Ifrane, two males, one unusually small (*Cockerell, A. Mackie*).

At Tangier, July 30, I caught a female with more dusky wings and stigma, the area of metathorax without the thickened margin, and with the plicæ running to the apex. This must be referred to *H. villosulus* Kirby, proper, though compared with a specimen from St. Helen's, Isle of Wight (*W. P. Cockerell*), the head is distinctly broader and the area of metathorax is longer. Specimens from Innsbruck (*Friese*) and Budapest (*Hedicke*) have the sculpture of the metathoracic area very fine and inconspicuous, and seem to constitute another race. Blüthgen has recorded both sexes of *H. villosulus* from Asni—no doubt, the race now described. He refers to the species (Deutsch. Ent. Zeits. 1922) as "so stark variierenden." I wondered whether *H. pauperatulellus* Strand, described from Algeria, could be the same as the Asni insect; but the description does not suggest this at all, and Alfken (Mém. Soc. Ent. Belg. 1914, p. 193) says that Algerian specimens of *H. villosulus* do not differ from German ones.

Blüthgen states that *H. medinai* Vachal, from Spain, is *H. villosulus*. I do not see how this can be, as it is based on a male 6 to 7 mm. long, the clypeus "limbo apicali flavo maculato." The endemic bees of Morocco are to be sought principally in the Atlas Mts., the fauna and flora about Tangier and along the coast generally being more European in type.

Hylæus breviscapus, sp. n.

♂.—Length about 4·5 mm., anterior wing 3·8.

Black, with the first tergite bright ferruginous; face, narrow border of prothorax (not reaching tubercles), tubercles, femora broadly at apex, and all the tibiæ and tarsi very bright yellow; mandibles black; face rather broad, but orbits converging below; yellow supraclypeal mark large and broad; lateral marks like feet on tip-toe, with slender ankles, extending upward along the orbits, leaving the orbit a little at upper end, and bulging a little on inner side next to antenna; scape very short, entirely yellow in front; second joint with a yellow spot; flagellum light red beneath; tegulæ pellucid, with a yellow spot. Wings hyaline, stigma and nervures light brown; first recurrent nervure meeting intercubitus. Thorax dull black, the disk of mesothorax, scutellum, and area of metathorax shining; mesothorax strongly punctured; area of metathorax very coarsely reticulate. First tergite strongly punctured, but shining; no hair-bands or spots on abdomen.

Morocco: Asni, Aug. 1930 (*W. P. Cockerell*).

Related to *H. xanthopoda* Vachal (*schmiedeknechti* Friese), but distinguished by the red first tergite, the duller and strongly punctured mesothorax, and the very much shorter scape.

Hylæus psilurus, sp. n.

♂.—Length about 5 mm., anterior wing 4.

Rather robust, black, with cream-coloured markings; face yellowish white, labrum and mandibles with light marks; supraclypeal area obtusely pointed above; lateral marks extending upwards along orbits, the inner portion opposite middle of supraclypeal mark, with its upper end transverse; head somewhat elongate, the face broad but much longer than wide; scape black, with a light stripe; flagellum reddish brown beneath; upper border of prothorax thickened, yellow, with a linear interruption in middle; tubercles yellow; thorax mainly dull, but scutellum shining; mesothorax strongly and closely punctured, the punctures running more or less in rows; scutellum with similar punctures, but not so dense; area of metathorax irregularly reticulate; tegulæ brown, with a yellow spot. Wings greyish, stigma and nervures brown; first recurrent nervure joining first cubital cell near end. Legs black, with the front tibiæ yellow in front, the middle and hind tibiæ with nearly or quite the basal half pale yellow, and the middle and hind basitarsi light except at apex. Abdomen shining; first tergite with very weak sparse punctures, and a little fringe of white hair at each side of apical margin.

Morocco: Fez, Sept. 1, 1930 (*Cockerell*).

The following table separates this from several similar males:—

	Upper border of prothorax all black	1.
	Upper border of prothorax partly or nearly all light	3.
1.	Tubercles black; scape with a light mark.	*annulatus* L.
	Tubercles with a light mark	2.
2.	Scape with a light mark; face broader ..	*bisinuatus* Foerster.
	Scape all black; face narrower.........	*nivalis* Morawitz.
3.	Prothorax above with two white marks, shorter than the interval between them .	*punctulatissimus* Smith.
	Prothorax above pale yellow, with only a linear interruption; face narrower...	*psilurus*, sp. n.

Hylæus lineolellus, sp. n.

♀.—Length about 4 mm., anterior wing 3·4.

Black, rather robust, the cream-coloured markings consisting of lateral face-marks, continuous band on upper margin of prothorax, tubercles broadly (nearly, but not quite, reaching transverse band), elongated spot on the pellucid tegulæ, broad band on outer side of front tibiæ, and more than basal half (as seen from behind) of middle and hind tibiæ; mandibles red except at base; flagellum dull red beneath; clypeus all black, finely longitudinally striate, and with scattered punctures; lateral face-marks shaped like feet on tip-toe, obtuse at upper end (which is more than halfway up front), and conspicuously notched just above the inner angle or heel; mesothorax dull, a little shining posteriorly, scutellum moderately but not conspicuously shining; both mesothorax and scutellum are strongly and densely punctured; area of metathorax large, with very coarse irregular radiating plicæ, which are more or less connected, forming an irregular reticulation. Wings hyaline, with brown stigma and nervures; first recurrent nervure falling just short of intercubitus. Abdomen shining black, with no hair-bands or spots; first tergite strongly and closely punctured to apex, second well punctured but the punctures smaller.

Morocco: Fez (type-locality), Sept. 1 (*Cockerell*); Asni, August (*W. P. Cockerell*).

In Hedicke's table of Central European species this goes exactly to *H. lineolatus* Schenck, but the face-marks are entirely different. It agrees with no species known from Morocco or adjacent regions. *H. styriacus* Foerster has quite similar lateral face-marks, but the head is rounder and there is a light spot on clypeus. *H. soror* Pérez is much more robust, and the face-marks are different. I had to consider whether this could be the female of *H. psilurus*, but on comparing specimens this does not appear possible.

XII.—*The Upper Valentian Trilobite Fauna of Shropshire.* By W. F. Whittard, D.Sc., Ph.D., A.R.C.S., F.G.S.

[Plates II.–V.]

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I. INTRODUCTION.

The fossils of Valentian age from British rocks offer a highly remunerative field for palæontological research. The present dearth of systematic descriptions of such organisms may be attributed to the confusion which existed last century concerning the stratigraphical relationships of what are now known as the Valentian or Llandoverian rocks, and also, partly because of this confusion, to the keenness with which numerous investigators amassed valuable collections of the faunas of the underlying and overlying strata now termed Bala and Wenlock respectively. When Murchison established his "Silurian System" he gave the name of "Caradoc Sandstone" to a group of sediments between the Wenlock Shales and Llandeilo Flags, and believed that the fauna from the "Sandstone" was uniform and not composite. While Murchison was occupied with the rocks of South Wales and the Welsh Borderland, Sedgwick had directed his attention to North Wales. More than to anything else, to Sedgwick's brilliant stratigraphical insight was due the realisation that the "Caradoc Sandstone" consisted of two distinct parts, an upper series, which was allied to the Wenlock, in many places separated by an unconformity from a lower series different from the Wenlock. The name Caradoc (equal to part only of Sedgwick's Bala) was later retained for the lower series, and the upper one was termed the Llandovery-Tarannon (Jones, O. T., 1921, pp. 144–152). While this stratigraphical tangle was being unravelled, several authorities had figured and described numerous so-called "Caradoc Sandstone" fossils. Many of these type-specimens have now been assigned to their correct geological horizons, but it so happens that amazingly few are of Valentian age. In consequence, the names now given to Valentian fossils are, with some exceptions, those of forms characteristic of the Wenlock, and, less commonly, of the Bala. My purpose in examining the Upper Valentian trilobite fauna from Shropshire is to help remedy an omission and to provide systematic descriptions of what I venture to claim is largely an undescribed assemblage; other students are conducting research on other animal groups from these rocks, and the total work may provide an impetus for the unravelling of the Valentian fauna as a whole. The Shropshire rocks, it should be remembered, are equivalent in time only to a small part of that represented by the full Valentian succession developed elsewhere.

II. STRATIGRAPHICAL SUCCESSION.

The Valentian rocks occur in three outcrops, viz., Main, Longmynd-Shelve, and Breidden Outcrops (Whittard, 1927, p. 737; and 1932, p. 859). The succession shows a lower group termed the Pentamerus Beds followed above by the Purple Shales. The Pentamerus Beds are predominantly blue-hearted mudstones and shales with occasional limestones and rottenstones, but arenaceous beds consisting of conglomerates, grits, and sandstones are usually developed at the base, where the rocks repose unconformably upon older sediments. The Purple Shales are composed almost entirely of maroon and green soft shales with infrequent limestones and flags, but in some localities where they rest directly upon pre-Silurian strata there is a marked lithological change and they are replaced by a series of sandstones.

III. ACKNOWLEDGMENTS.

I have endeavoured wherever possible to examine actual type-specimens, and it is here that I have pleasure in recording the unfailing courtesy which I have received from palæontologists both from home and abroad either for their readiness in sending me material or for their many kindnesses when conducting me round museums. My thanks are particularly due to Dr. E. Warburg, Mr. A. G. Brighton, Dr. A. Heintz, Dr. J. Koliha, Dr. P. O'Connor, Dr. C. Poulsen, Dr. E. Stensiö, the late Professor W. J. Sollas, Dr. L. Størmer, Dr. A. H. Westergård, Professor L. J. Wills, and Mr. T. Withers. The investigation has greatly benefited by the ready assistance given me by my friend Dr. C. J. Stubblefield, and I am also indebted to Dr. A. Wood for reading and criticising this manuscript. I also wish to acknowledge assistance from the Government Publication Grant administered by the Royal Society.

IV. THE TRILOBITE FAUNA.

The type-specimens in the author's collection have been presented to the Geological Survey Museum. Reference will be made to these and other specimens, and the following abbreviations will be used for the

Institutions in which they are housed, succeeded by the reference number of the specimen.

B: Geology Museum, Birmingham University. BM: British Museum. Natural History. GSM: Geological Survey Museum. RM: Riksmuseum, Stockholm. SM: Sedgwick Museum.

The list given below of the trilobite fauna from the Shropshire Valentian rocks includes certain forms which show few differences from species already fully described; these are marked with an asterisk and receive no further treatment here.

Illænus æmulus Salter. †PB, ps.
—— *arenaceus*, nov. pb, ps.
—— *proles* Holm var. *shelvensis*, nov. ps.
**Calymene planicurvata* Shirley. pb, PS.
*—— *replicata* Shirley. PB, PS.
Warburgella stokesi (Murchison). pb, PS.
—— *binodosa*, nov. ps.
Proetus sp. ind. ps.
Otarion elegantula (Lovén). PB, ps.
Leonaspis erinaceus (Marr & Nicholson) var. *salopiensis*, nov. pb, PS.
—— *marklini* (Angelin). pb, ps.
Primaspis parallela, nov. ps.
Lichas constrictus, nov. ps.
—— *marginatus* Lindström. ps.
—— *norvegicus* Angelin. ps.
**Corydocephalus hirsuta* (Fletcher). ps.
Encrinurus onniensis, nov. PS.
—— *mullochensis* Reed. PB, PS.
—— *shelvensis*, nov. PB, PS.
—— sp. ind. pb.
**Cheirurus bimucronatus* (Murchison). PS.
**Deiphon forbesi* Barrande, cf. var. *dikella* Whittard. pb, PS.
Phacops elliptifrons (Esmark). PB, PS.
Dalmanites weaveri (Salter), var. *tenuimucronata*, nov. PB, ps.
—— *vulgaris* (Salter), var. pb, ps.

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† PB and pb stand for characteristic and rare in the Pentamerus Beds, and PS and ps for characteristic and rare in the Purple Shales.

TRILOBITA.

Illænidæ Corda.

Doubt has been expressed regarding the value of the various subgenera of *Illænus*; both Holm (1882, pp. 45–54; & 1886, pp. 37–41) and Warburg (1925, p. 97) only accept *Illænus* and *Bumastus*, and reject the remainder, for they believe that a natural classification of the family has not yet been devised. Raymond (1916, pp. 1–15), on the other hand, grouped eight subgenera into the two subfamilies Illæninæ and Bumastinæ, the differentiating characters of which were the relative width of the axial lobe and the absence or presence of a concave border on the cephalon or pygidium [†]. I agree with Warburg that the nature of the border is relatively unimportant, and, furthermore, the type of *Bumastus barriensis* (GSM: 54421 & 54422) shows no concave external border to the pygidium as Raymond thought to be present from his study of plaster casts of this specimen. Consequently, the genotype of *Bumastus* does not exhibit a character which on Raymond's diagnosis is typical of the subfamily Bumastinæ. The relative breadth of the axis, and particularly the differences in the hypostoma and rostrum, may prove of more value in any classification erected in the future, but at the present time I prefer to use *Illænus* applied in its widest sense.

ILLÆNUS Dalman, 1826.

Illænus æmulus Salter.

1867. *Illænus* (*Dysplanus*) *æmulus* Salter, p. 187, pl. xxviii. fig. 5.
1882. *Illænus æmulus* Holm, pp. 38 & 50.
1904. *Illænus æmulus* Reed, p. 54, pl. viii. fig. 5.
[‡]1932. *Illænus æmulus* Whittard, table facing p. 896.
1935. *Illænus æmulus* Reed, p. 25, pl. ii. fig. 9.

Salter founded this species on a well-preserved pygidium which, in the text, he states to come from the "May

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[†] It is desirable when describing illænids to state explicitly whether the fossil is preserved with the test or as an internal cast. Frequently the pygidium shows no concavity parallel with the border when the test is present, but in the cast a faint groove is visible. The ventral doublure may also carry a broad groove on its upper surface seen when the overlying part of the pygidium and the intervening matrix has been removed.

[‡] To avoid needless repetition in all subsequent synonymies, references to the author's faunal list (1932, table facing p. 896) will be omitted.

Hill Sandstone of Upper Snead, near Chirbury, Shropshire" (1867, p. 188), while in the description of the plate the locality is given as Norbury. The correct locality is more likely to be the latter, but in any case the lithology is certainly that of the Pentamerus Beds. Pygidia of *I. æmulus* were recovered from the Pentamerus Beds of the Wrekin District, and they were associated with a cranidium which is thought to belong to the same species, as suggested by a complete specimen from Girvan placed by Reed as an unnamed variety of *I. æmulus* (1904, p. 55, pl. viii. fig. 7).

The cranidium (Pl. II. figs. 1 & 1 *a*, GSM: 55462) measures 30 mm. long and 31 mm. across the palpebral lobes, and is an internal cast. If the plane of the hinder margin be placed in the vertical position, then the height in side view is 14 mm. and length 17 mm. The broad, slightly converging furrows are 19 mm. apart at the posterior border and terminate at the level of the palpebral lobes in a clearly delimited depression, of which the flatter margin faces outwards; the surface of the cast at the base of this depression is, in part, finely granulated. Passing forwards from the front of the depression and curving outwards almost parallel with the anterior facial suture is an ill-defined shallow groove which ends in a pit (= axial pit of Salter); the centre of this pit, situated 5 mm. from the front of the cephalon and 3 mm. from the facial suture, is raised to form a tubercle. The unfurrowed glabella and occipital ring are fused into one smooth mass, which descends rapidly from back to front (Pl. II. fig. 1 *a*); there is a small tubercle in the mid-line 2 mm. in advance of the posterior border. The whole surface is covered by minute punctæ and anteriorly ornamented by a series of transverse low ridges running approximately concentric to the front margin. The punctæ here are almost confined to the areas between the ridges; on the palpebral lobes they are more closely packed and frequently deeper than elsewhere on the cranidium. Palpebral lobes are about 5 mm. long and possess a strong convex outline which originates between 4 and 5 mm. in front of the hinder margin. The anterior facial suture swings forwards and outwards from the lobe and cuts the front 16 mm. from the mid-line; the suture passes posteriorly from the lobe and is estimated to cut the back margin at an acute angle.

The pygidium of the holotype (Pl. II. figs. 2 & 2 *a–b*, GSM : 35991) is in the form of an internal cast and has been described by Salter †. It is 51 mm. broad and 35 mm. long, subsemicircular and convex. At the front the axis is 22 mm. broad, defined by wide furrows, which rapidly grow shallow and converge posteriorly, and the length is no more than 15 mm. The front of the axis is crossed by a shallow relatively wide furrow, and then follow between six and eight axial rings outlined by feeble and medially incomplete furrows. The fulcrum is 20 mm. from the median line, and here the outline suddenly turns downwards and outwards to define the slightly convex edge of the facet, the surface of which is vertical and 12 mm. long. Three pleural furrows occur on either side of the axis, but they do not reach the lateral margin. The hinder surface of the pygidium is provided with a series of inosculating narrow grooves which are arranged in a Λ-shaped manner ; some of the grooves transgress on to the axis, but none of them extends outwards to the margin, stopping about 10 mm. therefrom. The ventral doublure (partly known in specimen GSM : 55463 in which the test is preserved) increases in size posteriorly and is ornamented on its upper surface by several ridges each carrying linear series of small granules (Pl. II. figs. 3 & 3 *a*) ; similar granules are interspersed between the ridges. The caudal fascia is clearly delimited and identical with that described by Reed (1935, p. 25, pl. ii. fig. 9), but this structure is probably variable in the same species, for there are otherwise similar individuals possessing a much broader doublure and, in consequence, the fascia is more anterior.

Geological Horizons and Localities.—Pentamerus Beds of Norbury, Morrell's Wood near Leighton, Wagbeach near Minsterley ; arenaceous Purple Shales near Minsterley, and the Purple Shales, probably of the Onny Section, near Cheney Longville.

Material.—One cranidium and four pygidia from the Pentamerus Beds, and two pygidia from the Purple Shales.

Holotype.—GSM : 35991.

Remarks.—So far as I am aware, this illænid is distinct from any other type, and is characterized particularly

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† For comparison, the pygidium associated with the previously described cranidium is given on Pl. II. fig. 3.

by the shape and segmented axis of the pygidium as seen in casts and by the combined details of the cranidium.

Illænus arenaceus, sp. n.

1867. *Illænus* (*Dysplanus*) *bowmanni*, pars, Salter, p. 185, pl. xxviii. fig. 6.
1933. *Illænus* sp. indet., Reed, p. 130.

The new species will be described from a cranidium and pygidium isolated from one another, but found in the same block of rock and considered to be parts of the same individual.

The cranidium (Pl. II. figs. 4 & 4 *a*, GSM : 55464 & 55465) measures 11 mm. long and 12 mm. across the palpebral lobes, and in side view, when the plane of the posterior border is held vertically, the surface drops through a height of 7 mm. in a horizontal distance of 9 mm. Axial furrows trend slightly towards one another and terminate at the level of the palpebral lobes in well-defined depressions. A feeble groove originates from the front of the depression, swings outwards and forwards parallel to the anterior facial suture, and ends in a small axial pit carrying a median tubercle. Glabella and occipital ring are fused ; a small tubercle occurs in the mid-line, placed just in front of the posterior border. Palpebral lobes are strongly convex externally, a little less than 2 mm. long, the hinder margin being 1·5 mm. in front of the posterior border. Anterior facial suture swings outwards from the palpebral lobe and cuts the front margin about 5 mm. from the mid-line. Posterior branch curves only a little outwards to cut the posterior border fairly abruptly. Surface of the cranidium is covered with punctæ ; there are no transverse ridges.

The pygidium (Pl. II. figs. 5, 6, & 6 *a*, GSM : 55466 & 55467) is 12 mm. broad, 10 mm. long, and is almost devoid of furrows. The axial lobe probably occupies one-half the pygidial breadth at its anterior edge. The position of the axial furrows is indicated by a change in outline of the pygidium, and also by a change in direction of the transverse furrow situated immediately behind the anterior margin. This latter margin extends almost horizontally until the fulcrum is attained, whence the border turns obliquely backwards forming the edge of the vertically placed facet. A groove behind the facet is a continuation of that crossing the axis. In longitudinal section the pygidium is convex, reaching a height of about 3 mm. in the mid-length. As the pygidial edge is followed forwards from the posterior margin, a shallow broad groove commences and eventually joins the groove behind the fulcrum. This groove is, however, much more noticeable in the cast than on the actual test. The test possesses a punctate surface and exhibits posteriorly a series of narrow, almost concentric, terraced lines.

The specimens from the Bog Mine Outliers, near Shelve, are larger than the above-mentioned forms, but they are confidently included in the same species. The fossil from Hope Quarry described by Reed (1933, p. 130, GSM : 35320) is not very well preserved, and although it does not show all the features given in the description of *I. arenaceus* it is referred there.

Geological Horizons and Localities.—Pentamerus Beds of Wagbeach near Minsterley and of Hope Quarry, but the species is more common in the arenaceous development of the Purple Shales at the Bank Outlier near Minsterley, and in the Bog Mine Outliers.

Material.—One cranidium and a pygidium from the Pentamerus Beds and one cranidium and six pygidia from the arenaceous Purple Shales; the specimens are internal casts and on one a little of the test still adheres.

Syntypes.—GSM : 55464–55467 inclusive.

Remarks.—The pygidium is close to that of *Illænus triloba* (Weller, 1907, p. 226, pl. xix. fig. 14), but the cephalon is quite different. It should be noted that an obscure specimen referred by Salter (1867, p. 190, pl. xxxviii. fig. 4, GSM : 35996) to *Illænus* (*Dysplanus*) *thomsoni* is actually a fragment of a valve of a *Meristina*-like brachiopod seen on its inner surface.

Illænus proles Holm var. *shelvensis*, var. nov.

An internal cast of a cranidium, incomplete anteriorly, measures 42 mm. across the palpebral lobes (Pl. II. fig. 7, GSM : 55468); another specimen (Pl. II. fig. 8, GSM : 55469) suggests that the ratio of length to breadth is 2 : 3, so the holotype may have an estimated length of 28 mm. Axial furrows are subparallel and sink into pits at the posterior border, where they are 20 mm. apart. The furrows extend over the cranidial surface for 13 mm. and end in advance of the palpebral lobes, which commence 4 mm. in front of the posterior border. Anteriorly delimited by a sharp groove, there is a narrow band a little less than 1 mm. wide, which defines the posterior cranidial margin. Palpebral lobes occur far back on the cephalon, are about 4 mm. long, and show a strongly convex external outline. Posterior facial suture swings back and out from the lobe and cuts the hinder margin 9 mm. from the axial furrow; consequently, the fixed cheek is pronounced and relatively large. I am unable to excavate completely the anterior suture in the holotype, but in GSM: 55469 it passes obliquely outwards and forwards from the palpebral lobe.

Geological Horizons and Localities.—Arenaceous Purple Shales from the Napp Outlier near the Bog Mine, and the Purple Shales of the Minsterley-Habberley lane 1/6 mile from the Shrewsbury main road.

Material.—Three cranidia.

Holotype.—GSM: 55468.

Paratype.—GSM: 55469.

Remarks.-The new variety is close to *Illænus proles* (Holm, 1886, p. 154, pl. xi. figs. 1–3) in which the fixed cheeks are relatively large and the axial furrows extend beyond the palpebral lobe, but it differs in being much less convex.

Proetidæ Corda.

Kegel (1927, p. 637, footnote) has used the name *Prionopeltis* Corda (Hawle & Corda, 1847, p. 121), genotype *P. archiaci* (Barr.), for the forms included by Barrande in the pre-occupied genus *Phaeton* (1846, p. 61); this was later called *Phaetonides* by Angelin (1854, p. 21), who greatly extended under the new name the meaning of the genus and included species which Novák (1890, p. 12) correctly maintained to belong to three different genera. *Prionopeltis* has priority over *Phaetonides*, and the latter should now be discarded. Reed (1935, p. 42) states that Kegel places *P. stokesi* in a new genus *Cyphoproetus*, whereas Kegel actually says "Welche systematische Stellung *Stokesii* und den anderen genannten Formen zukommt, ist eine Frage fur sich. Mit *Prionopeltis* und *Cyphoproetus* haben diese Arten trotz einiger Anklänge nichts zu tun" (1927, p. 637, footnote). Warburg (1925, p. 184) has also summarized the opinions held regarding the genus *Phaetonides*, and has remarked that *P. stokesi* and *P rugulosus* should probably be referred to a new genus. Reed (1931, p. 14), has proposed *Warburgella* with *Warburgella stokesi* as the genotype. Unfortunately, I have been unable to trace Murchison's type-specimen (1839, p. 656, pl. xiv. fig. 6), and thus it is necessary to choose a neotype; for this I propose specimen no. 335 from the Ketley Collection in the Geology Museum, Birmingham University. This individual closely resembles the original drawing, and it is not impossible that it is the actual holotype.

WARBURGELLA Reed, 1931.

Warburgella stokesi (Murchison).

A synonymy of the species is given by Reed (1904), and to this may be added the following:—

1878. *Proetus nasiger* Edgell MS, Newton & Etheridge, p. 72.
1890. *Proetus stokesi* Novák, p. 11.
1904. *Proetus stokesi* Reed, p. 79, pl. xi. figs. 10 & 11.
1925. "*Phaetonides*" *stokesi* Warburg, p. 184.
1927. *Proetus stokesi* Kegel, p 637.
1927. *Proetus* sp. undescr, Whittard, p. 751.
1931. *Proetus* (*Warburgella*) *stokesi* Reed, p. 14.
1935. *Proetus stokesi* Reed, p. 42.

The neotype is oval, being 13 mm. long and 10 mm. broad (Pl. III. fig. 1, B: 335); the test is almost smooth. Cephalon is approximately twice as broad as long, almost semicircular in shape, and possesses a pair of pronounced genal spines. Glabella is as long as broad, rounded anteriorly, moderately convex, and composed of a large central lobe with prominent basal lateral lobes. The oval basal lobes and the basal lateral furrows are directed forwards and outwards, while the latter die out a little before the axial furrow is attained. Occipital ring carries a pair of clearly defined lobes, and the occipital furrow is not deeply impressed. Anterior border pronounced, extends back on to the genal spines, and shows a series of delicate grooves; the anterior border furrow is strong and passes back to the genal angle to meet the posterior border furrow. Preglabellar field short medially, convex longitudinally, and expanding laterally towards the facial suture. Free cheeks large and supplied with genal spines extending posteriorly probably as far as the front of the pygidium. External to the eyes there is a flat subtriangular area contained between the lateral and posterior border furrows. Facial suture extends inwards from the anterior border at about 45° to the mid-line, while the posterior branch cuts the hinder margin at an acute angle. Eyes are large, semilunar in shape, smooth, a little more than half the length of the glabella, and extend back almost to the posterior border furrow. Fixed cheeks practically non-existent, for the eye is close alongside the axial furrow. Palpebral lobe is large.

Thorax probably consists of ten segments, although only nine are shown in the neotype because the cephalon overlaps the anterior portion of the thorax. The axis, clearly defined by furrows, tapers posteriorly, but the thoracic breadth remains almost constant. Anterior axial rings occupy about one-third the breadth of the thoracic segments; axial rings moderately convex and carry articulatory half-rings and furrows. Pleuræ prolonged into short downturned spines, and their breadth remains almost the same throughout the thorax; pleural furrows present, and the indefinite fulcrum is about midway along the pleura.

Pygidium is semicircular with a pronounced axis showing at least eight segments, and a feebly developed postaxial ridge. Five or six pleuræ are indicated, and the pygidial margin is entire.

Geological Horizon and Locality.—Wenlock Limestone of Dudley, Staffordshire.

Neotype.—No. 335, Ketley Collection, Geology Museum, Birmingham University.

Remarks.—The Shropshire specimens show no important difference from the type-specimen described above. The Pentamerus Beds of the Wrekin District have yielded an individual which possesses a slightly less pronounced anterior border on the cranidium and two less segments on the pygidium, but these are trifling differences (Pl. III. figs. 2 & 2 *a*, GSM; 55470 & 55471). Some specimens were collected by Wyatt Edgell from the Purple Shales of the Onny River Section and given by him the manuscript name of *Proetus nasiger* (Newton & Etheridge, 1878, p. 72, GSM: 35998, 35999, 36001), but, except for a more rounded outline, there are no other characters that distinguish *P. nasiger* from *W. stokesi*. One of these specimens has the under side of the tumid anterior border preserved as a mould and the rostrum, nearly 2 mm. long, is well exposed (Pl. III. fig. 3, GSM: 35999); the rostrum is trapezoidal, the parallel anterior and posterior margins measure 2 and 1 mm. respectively, and the connective sutures diverge anteriorly. The ornament consists of a series of grooves arranged concentrically to the front margin, and the general surface is concave longitudinally as seen in the mould.

Warburgella binodosa, sp. n.

Glabella is bluntly rounded anteriorly, parabolic in outline, and limited caudally by the moderately impressed occipital furrow (Pl. III. fig. 4, GSM: 36000). Central lobe is convex and shows no furrows; basal lateral lobes are ovoid, separated from the rest of the glabella except for a short distance along their anterior length, their longer axis is directed obliquely outwards at 30° to the mid-line, and they are just less than half the length of the glabella. Axial furrows are incised in front of the basal lobes, and continue forwards as the preglabellar furrow. Mesially, this latter furrow is joined by the anterior border furrow; traced laterally on either side of the mid-line, the two furrows diverge, and include between them an upraised convex nodular mass which reaches as far as the facial suture. The region preceding the anterior border furrow is swollen and exhibits a strongly arched margin; such a swollen border constitutes the tropidia of some writers. Occipital ring is broad relative to its length and carries a pair of occipital lobes. Eyes are placed immediately alongside the glabella and, consequently, the fixed cheeks are diminutive. Facial suture trends inwards from the anterior margin straight towards the front of the basal glabellar lobes, it must arch laterally to form the palpebral lobe (which is not preserved), and then bends outwards in its posterior course to make an acute angle of about 15° with the hinder margin of the head shield, which it cuts about 1 mm. from the axial furrow. The glabella, preserved as an internal cast, shows a tuberculated surface. Free cheeks must have been relatively large.

Geological Horizon and Locality.—Purple Shales of the Onny River Section near Cheney Longville.

Material.—One specimen preserved as an internal cast.

Holotype.—GSM : 36000, Wyatt Edgell Collection.

PROETUS Steininger, 1831.

Proetus sp. ind.

Glabella, preserved with the test intact, is slightly shorter than broad, attaining a maximum breadth of 4·5 mm. at the base of the palpebral lobe (Pl. III. fig. 5, GSM : 55472). Three pairs of glabellar furrows are present, the two anterior pairs are transverse, while the third pair delimits the basal lateral lobes; all the furrows are extremely faint and difficult to discern. Preglabellar furrow describes part of a broad curve and then swings back as the axial furrows which show a conspicuous waist opposite the basal glabellar furrow. Only a small area of the occipital ring is visible. Preglabellar field moderately developed, shortest medially, expanding laterally. Anterior border convex, short, with a strong border furrow. Anterior facial suture almost straight, directed backwards and inwards. Palpebral lobe close to the axial furrow, but further details are lacking. The whole of the cranidium is covered by a characteristic ornament of delicate discontinuous ridges which are usually subparallel, but may be inosculating or branching; the test also shows several minute shallow pits, which may be accidental.

Geological Horizon and Locality.—Recovered from a thin limestone rich in *Barrandella linguifer* interbedded in the Purple Shales of the Minsterley-Habberley lane 1/6 mile from the Shrewsbury main road.

Remarks.—The specimen differs from *Prionopeltis octaschistus* (Kegel, 1927, p. 631, pl. xxxi. figs. 8–10) in possessing a narrower preglabellar field and by its ornamentation, from *Phaetonides densistriatus* (Kummerow, 1927, p. 37, pl. ii. fig. 10) in the shape of the anterior border, from *Phaetonides rugulosus* (Lindström, 1885, p. 75, pl. xvi. fig. 13) in the glabellar shape and in the anterior border, and from *Proetus intermedius* (Barrande, 1852, p. 464, pl. xvi. figs. 31–33) in the ornament of closely set grooves and ridges as compared with a granulated surface of the Bohemian species.

Otarionidæ R. & E. Richter.

Otarion (Zenker, 1833, p. 44, pl. iv. figs. L & S) and *Cyphaspis* (Burmeister, 1843, pp. 103–5, pl. iii. figs. 3 & 4) were both illustrated by several figures, but unfortunately the coloured drawings of the former genus are not clear and include different animals. Nevertheless, Zenker gave reconstructions of *O. diffractum* as viewed from above and from the side (*op. cit.* p. 47, pl. iv. figs. Q & R), and these show that he was mainly describing a trilobite which does not differ materially from other forms later included under *Cyphaspis*. He failed to detect the presence of eyes in the fragmentary material at his disposal, but, although the reconstructions are not good, sufficient is indicated of the cranidial structure to suggest that *Cyphaspis* and *Otarion* are synonymous; *Otarion*, with *O. diffractum* as genotype, should thus be retained since it has ten years' priority †.

Salter (1864, p. 3, classification table) associated *Otarion* with *Aulacopleura* in the new family Cyphaspidæ, but owing to the changed nomenclature this should be altered to Otarionidæ as already proposed by the Richters (1928, p. 56).

OTARION Zenker, 1833.

Otarion elegantula (Lovén) ‡.

1846. *Proetus elegantulus* Lovén, p. 51, pl. i. fig. 4.
1846. *Harpes* (?) *megalops*, pars, McCoy, p. 54.
1849. *Harpidella megalops*, pars, McCoy, p. 412.
1851. *Proetus elegantula* Angelin, p. 21, pl. xvii. figs. 7 *a* & *b*.
1854. *Goniopleura elegantula* Angelin, p. 23, pl. xvii. fig. 7.
?1855. *Harpidella megalops* McCoy, p. 143.
1885. *Cyphaspis elegantula* Lindström, p. 76.
1901. *Cyphaspis elegantula* Lindström, p. 52, pl. iii. figs. 22–25.

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† In Opinion 88 (International Rules of Nomenclature, 1926, p. 103) *Otarion* is considered valid, and is preferred to *Cyphaspis*; see also R. & E. Richter, 1926, p. 95.

‡ This species is usually attributed to Angelin, who listed it in 1838 (no. 21) in collections of Swedish fossils which he distributed to certain Museums, but he gave neither figure nor description, and the type (if there were one) is unknown; as Westergård (1910, p. 28) has already shown, the first account was provided by Lovén, who thus stands as the

1905. *Cyphaspis megalops* Reed, p. 98.
1907. *Cyphaspis megalops* Reed, p. 537.
1910. *Cyphaspis elegantula* Westergård, pp. 6 & 28.
1927. *Cyphaspis elegantula* Kummerow, p. 39.

Only cranidia have been collected and the median length varies between 3·8 and 4·8 mm. Glabella (Pl. III. fig. 6 : GSM 55473) is parabolic in outline and convex ; central lobe forms the highest region of the head-shield, and is sharply outlined by deeply incised furrows. Preglabellar and axial furrows describe a semicircle round the front of the central lobe, the postero-lateral sides of which are defined by the almost straight basal lateral glabellar furrows ; posteriorly the lobe is more elevated than the occipital ring, from which it is separated by the occipital furrow. The pair of second lateral glabellar furrows on the central lobe described by McCoy in *Otarion megalops* (1846, p. 54, and 1849, p. 412) are either absent or so feeble that they are difficult to discern. Basal lateral glabellar lobes are completely circumscribed by the deep axial, occipital, and basal lateral glabellar furrows, and thus they appear as upstanding nodules, elongated medianly. Axial furrow describes a parabola, and delineates the glabella from the remainder of the cranidium. Preglabellar field is strongly developed, convex longitudinally, gently arched transversely, and expands laterally to terminate against the facial suture. Anterior border furrow is deep and preceded by a well-developed, inclined, flat border. The frontal margin describes a smooth curve, but in some specimens it is bluntly pointed ; such differences in curvature are known in several species of *Otarion*, and since there are generally two different shapes, this may be a sexual character. Occipital ring is transversely and longitudinally convex. Posterior border is narrow and a furrow is present. Fixed cheeks reduced in consequence of the position of the eyes, and consist of a triangular posterior area and a narrow elongated region lying between the axial and palpebral furrows. This latter region is confluent anteriorly with the laterally expanded area of the preglabellar field. Facial suture sweeps inwards when followed anteriorly from the palpebral lobe, and then curves outwards to cut the front margin almost directly in front of the outer edge of the palpebral lobe. Posterior branch of the facial suture trends outwards to the posterior margin, with which it makes an angle of about 30°. Palpebral lobe is relatively large, almost semicircular, and defined internally by the almost straight palpebral furrow; an indefinite groove joins the palpebral and deep preglabellar furrows. Palpebral lobe is situated far back on the cephalon, and reaches from just anterior of the front of the basal glabellar lobes to a point about two-thirds along their length. The eye must have been of considerable size when compared with the general proportions of the cephalon.

Geological Horizons and Localities.—Frequently occurs in the Mudstone Phase of the Pentamerus Beds and has been found at Morrell's Wood near Leighton, Shineton, and Snead, but it is also known from the Purple Shales of Hughley Brook and their arenaceous development at the Bank Outlier near Minsterley.

Remarks.—*Otarion megalops* was described by McCoy from sandstones exposed near Ardaun, Boocaun, Cappacorcogue, and Tonlegee, near Cong in County Galway (1846, p. 54, pl. iv. fig. 5). Dr. P. O'Connor has sent me a plaster cast of a specimen from Boocaun which he believes to be the type and which shows two individuals of *Otarion*; the cast does not agree with McCoy's figures, but Dr. O'Connor is of the opinion that the figures are of a composite character and not an exact illustration necessarily of any one specimen. Again, the outlines of the slab carrying the fossils are different in the figure and the cast, but the representation of this outline seems to have been purely conventional. It may provisionally be accepted that the specimen from which the cast has been made was the one mainly used for McCoy's figures. One of the individuals shown on the cast agrees with the description of *O. megalops*, but the other is certainly a different species of the same genus. In addition to the basal lateral glabellar furrows, *O. megalops* shows another pair of lateral glabellar furrows in front of these (Pl. III. fig. 7), which were noticed and described by McCoy, whereas on the second individual these furrows are wanting or only feebly indicated; in this respect this specimen agrees with the Shropshire material, which consequently in its turn cannot be assigned to *O. megalops*. The latter specimens are identified as *O. elegantula*, and the second and smaller specimen from

Boocaun may also be placed here temporarily. McCoy determined the horizon of *O. megalops* as Silurian, but at Boocaun it is associated with *Cœlospira hemispherica* which definitely fixes the age as Valentian.

Salter refigured from Wenlock and Ludlow rocks some complete and fragmentary trilobites which he referred to *Otarion* [*Cyphaspis*] *megalops*, and his identification was checked by McCoy (Salter, 1853, Dec. vii. pl. v. figs. 1-7). Salter's descriptions were largely founded upon a specimen from Hole Farm, near Woodbury, Abberley Hills, which was collected from Lower Ludlow rocks (Salter, *op. cit.* pl. v. figs. 1 & 1*, GSM: 36740); apart from the difference in geological age and the feebleness of the lateral glabellar furrows, the anterior position of the eye and the subrectangular shape of the glabella distinguish it from *O. megalops*. The Wenlock specimens (Salter, *op. cit.* pl. v. figs. 2, 2*, 3, 3* & 7, SM: A4841 & 4842) are really closer to *O. elegantula*, but they differ in the position of the palpebral lobe, which is usually more anteriorly placed in this species and not so far forwards as in the Lower Ludlow form mentioned above. Excluding the type of *O. megalops*, the three Silurian forms appear to constitute a species-group in which the palpebral lobe migrated forwards on the cranidium, the Upper Valentian *O. elegantula* possessing the eyes almost on the same level as the basal glabellar lobes, while in the Lower Ludlow form the eyes are clearly well in front of these lobes; the eyes of the Wenlock specimens occupy an intermediate position.

Salter separated *O. pygmæus* from *O. megalops* (1853, Dec. vii. p. 6, pl. v. GSM: 36142), but later Lindström gave this species as a synonym of *O. elegantula* (1885, p. 76); the holotype has been badly rubbed, and the details of the cranidium are indeterminable, but there seems to be no evidence of the spine on the axis of the sixth thoracic segment. There are twelve thoracic segments, and the individual may be fully grown. The small size was relied on by Salter in making a new species, but more material is required before the affinities can be ascertained. Should this diminutive type be truly specifically different from other Salopian species and not synonymous with *O. elegantula*, then a new name will have to be given, for *Otarion pygmæus* has been proposed for a specimen from the Clymenia Limestone which is obviously different from Salter's species (Münster, 1842, p. 115, pl. x. fig. 11).

Specimens referred to *O. megalops* from the St. Martin's Beds of Haverfordwest of Lower Valentian age are apparently identical with *O. elegantula* (Reed, 1905, p. 98, and 1907, p. 537, SM : A 4647–A 4649).

Odontopleuridæ Burmeister.

The nomenclature of the trilobite family now known as the Odontopleuridæ has been in a state of flux for many years, but apparently from the researches of the Richters this was the first published family name (R. Richter, 1932, p. 142). The Richters subdivided the genus *Acidaspis* (s. l.) into several subgenera (1917, p. 462), but they have more recently decided that some of these are of generic rank (1930, p. 33), while others, such as *Pseudomonaspis* and *Miraspis*, must be discarded (1925, p. 126). Reed took as a foundation the subdivisions proposed by the Richters and considered the various subgenera from the point of view of the development of what he termed the postcentral lobe and furrow (1925 *b*, pp. 416–430). His conclusions were unacceptable to several investigators, and Warburg has now criticized them (1933, pp. 1–19). The occipital ring in the *Odontopleura* group is much more complex than in the *Leonaspis* group, and this led Reed to argue for the presence in the former of a postcentral glabellar lobe overlying the true occipital ring. By a study of the thoracic segments in *Odontopleura* and *Ceratocephala* Warburg has concluded that Reed was incorrect in his interpretation, and that the so-called postcentral lobe and furrow do not belong to the glabella proper, but correspond to the occipital ring and furrow as previously supposed.

LEONASPIS R. & E. Richter, 1917.

Leonaspis erinaceus (Marr & Nicholson) var. *salopiensis*, var. nov.

1878. *Acidaspis dama* ?, Fletcher & Salter MS., Newton & Etheridge, p. 72.
1888. *Acidaspis dama* Marr & Nicholson, p. 714.
1896. *Acidaspis Dama* Lake, p. 243.
1925 *b*. *Acidaspis dama* Reed, p. 428.

Acidaspis dama, a manuscript name attributed to Fletcher and Salter, has received notice in several publications, but no description or drawing has appeared in print. It has not been possible to trace the undescribed type, because two or perhaps three species are represented by the specimens referred to *A. dama* in the Geological Survey Museum. To avoid further confusion *A. dama* should rank as a *nomen nudum*.

Excluding spines, the cephalon is a little more than twice as broad as long, and is characterized by a prominent spine at each genal angle and an unpaired median spine directed posteriorly from the occipital ring (Pl. III. fig. 8, GSM : 55474 & 55475). Tubercles are scattered over the cephalon, but are absent from the grooves. Glabella is prominent and widest posteriorly (Pl. III. fig. 9, GSM : 55476). It rises sharply at first from the anterior border furrow, then less steeply, and reaches a maximum elevation at the level of the second lateral glabellar furrows; thence it falls gradually and finally descends suddenly into the occipital furrow. Central lobe is expanded anteriorly and almost parallel-sided posteriorly, where it occupies a little less than half the glabellar breadth. Two pairs of completely circumscribed and unequal lateral lobes are developed, and in certain individuals there are suggestions of another diminutive pair situated just posterior to the position where the eye ridge joins the central lobe. Occipital furrow is highest medially and descends laterally, being deepest behind the third lateral lobe, where also the pronounced axial and longitudinal furrows coalesce. Feebly defined occipital lobes appear to be present in some specimens. Occipital ring descends rapidly on either side of the mid-line and carries a median spine, swollen at the base, which extends backwards for a distance at least equal to the length of the cephalon, and maintains a uniform thickness throughout its course (Pl. III. fig. 8). Anterior border is slightly upturned and short medially, but lengthens laterally; front margin is straight and shows in some internal casts about twelve spinose tubercles. Postero-laterally the border descends into a pit which gradually becomes shallow and disappears alongside the facial suture midway between the palpebral lobe and the cranidial front. Fixed cheeks are narrow, attain their greatest elevation at the palpebral lobe, posterior to which they assume a rapidly increased breadth, and fall suddenly to the posterior border furrow which they overhang. Eye ridge connects to the front of the glabella, and is provided with several pronounced tubercles; the ridge extends back to the palpebral lobe, and describes a course parallel to the cheek-roll from which it is separated by an ill-defined groove. Facial suture extends from the frontal border almost parallel to the glabellar axis, and it is only slightly curved. Posterior branch turns outwards through a right angle, and curves backwards to meet the posterior cephalic border just internal to the base of the genal spine. Eyes are placed far back and raised on stalks. Free cheeks are subtriangular, widest and highest opposite the eyes, from which they gradually descend, and then ascend marginally to form a pronounced lateral border ridge. Outside the ridge the lateral border is narrow, and provided with eleven radially arranged spines; these are short anteriorly, but increase in length towards the genal angle. Genal spines are stout, tuberculated and directed outwards at an initial angle of about 40° to glabellar axis.

Thorax consists of nine segments (Pl. III. figs. 10 & 11, GSM: 55477 & 55478). Axial rings maintain an almost constant breadth, are strongly convex, and lateral nodules are present. Pleuræ are almost flat, extend horizontally, then turn sharply downwards and backwards at the fulcrum, forming sabre-like spines of unequal length; these pleural spines are the lateral extensions of the well-developed subcentral ridges. The subcentral ridge carries one tubercle at the fulcrum and one or two close to the axial furrow, and it is limited in front and behind by a flat border.

Pygidium is subsemicircular, being about three times as broad as long (Pl. III. figs. 10 & 12, GSM: 55477 & 55479); the margin carries four or five pairs of spines, of which the second or third pair, as the case may be, is much longer than the others. In one example two spines are joined, while the corresponding couple on the opposite side are separate (Pl. III. fig. 13, GSM: 55480 & 55481). Axis is convex, pear-shaped, and bluntly terminated. Three axial rings are present, which may, or may not, carry a tubercle on either side of the axis; the anterior axial ring is provided with an articulatory half-ring and furrow. Lateral portions of the pygidium are moderately flat, except for the strong pleural ridges which commence from the anterior ring, pass outwards at first almost horizontally, then turn abruptly backwards, and are prolonged as the largest spines on the pygidium. Where the angulation in the pleural ridge occurs there is usually a tubercle.

Geological Horizons and Localities.—Pentamerus Beds of Snead and the Wenlock Valley; Purple Shales of the Onny Section near Cheney Longville, the Minsterley-Habberley lane, Gilberries Brook, and Hughley Brook.

Material.—Twenty-two specimens from the Purple Shales and two from the Pentamerus Beds have been examined.

Syntypes.—Eight specimens have been utilized in the description of the variety, GSM: 55474–55481 inclusive.

Remarks.—The syntypes of *Acidaspis erinaceus* (Marr & Nicholson. 1888, p. 723, pl. xvi. figs. 11–12) are distorted by cleavage, yet the close similarity to our variety is apparent in the glabella, in the proportions of the occipital spine. and in the general build of the pygidium. The species is about one-third the size of its variety *salopiensis*, has the occipital lobes better defined, and possesses eight thoracic segments (SM: A 4874). The full number of segments for the species may be greater than eight, for in the other syntype six only occur (SM: A 4875), and thus both may be immature individuals at different stages of development. Marr and Nicholson (*op. cit.* p. 714) considered that the Stockdale Shale trilobite fauna nearly approaches that of the Purple Shales as obtained from the Onny Section, and noted that the so-called *A. dama* is like *A. erinaceus*, the differences between them probably eventually proving to be of varietal degree. Such a view finds support here, for the likeness between the two forms is much more apparent than their dissimilarity, and the differences that do occur can be attributed to the fact that *A. erinaceus* is probably a stunted form found in a shelly horizon interbedded in a normal graptolitic succession, and that conditions of deposition were unlike those which obtained in the shallow water zone characterized by the variety. *L. erinaceus* var. *salopiensis* is similar to *L. marklini* (see p. 108), but the latter is a larger form, possesses a more triangular glabella due to a less antero-lateral development of the central lobe, the occipital spine is probably smaller and, in fact, may only be a large tubercle, the ornament is coarser and consists of fewer tubercles, and the edge of the frontal border is smooth and unprovided with a series of small spinose tubercles, but since the comparison between *L. erinaceus* var. *salopiensis* and *L. marklini* is founded upon the internal cast of one and the test of the other, some of the differences may be more apparent than real. Marr and Nicholson (*op. cit.* p. 723) alluded to the resemblance between *A. centrina* (Dalman, 1828, p. 135)[†] and *A. erinaceus*, consequently it is necessary to determine how our variety differs from this species. Dalman did not figure *A. centrina*, and Wahlenburg's and Angelin's figures of *A. granulata* have to be consulted; the obvious differences are the absence of a preglabellar field and an occipital spine, and the development of three elongated pygidial spines. According to Lindström (1885, p. 55) *Acidaspis pectinata* (Angelin, p. 33, pl. xxi. fig. 5) is identical with *A. dama* (=*Leonaspis erinaceus* var. *salopiensis*), but it certainly differs from the Onny River specimens, since it shows no occipital spine, the preglabellar field is dissimilar, the eyes are more anteriorly placed, and the lateral lobes of the glabella are proportionately much smaller than the central lobe. *L. erinaceus* var. *salopiensis* shows affinities particularly with *L. leonhardi* (Barrande, 1846, p. 58; and 1852, p. 720, pl. xxxvii. figs. 1–11) and *L. minuta* (Barrande, 1846, p. 59; and 1852, p. 729, pl. xxxvii. figs. 18–22); both species possess an occipital tubercle, while the latter species is characterized by a relatively broader cranidium due to the wider cheek roll, and by the pleural spines of the thorax combining to produce an open instead of a compact appearance.

[†] Wahlenburg (1821, p. 30, pl. ii. figs. 4 & 4*) confused two fossils under the name *Entomostracites granulatus*, one being a trinucleid (fig. 4) and the other an odontopleurid (fig. 4*). The trinucleid was the first figured and described, while the rest of the account was founded upon the thorax and pygidium of the odontopleurid. Consequently, the specific term *granulatus* can be maintained for the trinucleid but not for the odontopleurid. Angelin (1854, p. 37, pl. xxii. fig. 11) recorded under *Acidaspis granulata* a form which he considered as identical with Wahlenburg's type. Later Dalman erected *A. centrina* (*op. cit. supra*), and, if, as Linnarsson maintained (1869, p. 65), this proves to be the same as the specimens Angelin and Wahlenburg had in mind, then *A. centrina* should prevail over *A. granulata*.

Leonaspis marklini (Angelin).

1854. *Acidaspis marklini* Angelin, p. 38, pl. xxii. fig. 13.
1854. *Acidaspis multicuspis* Angelin, p. 37, pl. xxii. fig. 12.
1885. *Acidaspis marklini* Lindström, p. 54, pl. xiii. figs. 8 & 15, and pl. xvi. fig. 10.
1896. *Acidaspis marklini* Lake, p. 238.

The cranidium alone is known from Shropshire (Pl. III. fig. 14, GSM : 55482). Glabella is parabolic, and consists of an almost parallel-sided central lobe, and two pairs of lateral glabellar lobes which are well-defined by the surrounding furrows. The top of the central lobe is ornamented by large tubercles arranged roughly three abreast. Occipital furrow is highest medially and descends laterally to the circular occipital lobes; a centrally placed tubercle (surface broken in the specimen) occurs on the occipital ring. Posterior border of the cranidium is a continuation of the ring but at a much lower plane, has anteriorly an ill-defined groove, and is markedly overhung by the fixed cheek. Steeply inclined anterior border is finely granulated, short medially, but expands laterally ; it descends postero-laterally into an elongated pit situated in front of the eye ridge, and can be followed almost to the palpebral lobe. Anterior margin is straight and carries no spines or tubercles. Convex, arcuate fixed cheeks are narrow and tuberculated; caudal to the palpebral lobes they turn under and downwards to the posterior border furrow. Eye ridge pronounced from its inception at the antero-lateral corner of the central glabellar lobe as far as the palpebral lobe ; separated from the fixed cheek by a clearly defined groove. Facial sutures extend from the front margin subparallel with the glabellar axis, and, after attaining their greatest elevation at the palpebral lobe, rapidly lose height, turn outwards through a right angle, and gently curve back to meet the posterior margin of the cephalon 8 mm. from the mid-line. Eyes were situated far back and opposite to the middle of the postero-lateral lobes of the glabella.

Geological Horizons and Localities.—Pentamerus Beds of Shineton, the Purple Shales of the Onny River Section near Cheney Longville, and the arenaceous Purple Shales of the Bank Outlier near Minsterley.

Material.—One specimen from the Pentamerus Beds and three from the Purple Shales.

Remarks.—The holotype of *Acidaspis marklini* (Angelin, 1854, p. 38, pl. xxii. fig. 13, Upsala Museum) shows little of the cephalon, but the thorax and pygidium are moderately well preserved as an external mould. Lindström was able to describe the species in greater detail, but he selected another specimen which is complete except for the free cheeks (1885, p. 54, pl. xiii. fig. 15, RM : Ar 6339). The post-cephalic test is identical in the two specimens, and thus Lindström's account may be accepted in lieu of Angelin's meagre notes. The cranidium from Shropshire differs in minor features from the original used by Lindström, since in the latter the glabella is more downturned anteriorly, the anterior border is less inclined, and the eye does not overhang the posterior border to such an extent. If, however, another but smaller specimen also figured by Lindström be consulted (*op. cit. supra*, pl. xvi. fig. 10, RM : Ar 6340) †, then the only character in which they do not agree is the inclination of the anterior border. The naming of the Shropshire specimen as *L. marklini* depends on the identity of Lindström's two type-specimens with Angelin's holotype.

Lake (1896, p. 238) has stated that *A. marklini* and *A. coronata* are identical; he also believes that these are possibly synonymous with ? *Odontopleura mutica* described by Emmrich (1845, p. 44), but is unprepared to decide until the type of this last species is redescribed. *A. coronata* was erected by Salter (1853, Dec. vii. p. 7, pl. vi.; and 1857, p. 210), and the holotype (GSM : 36734) was collected from Lower Ludlow strata at Vinnal Hill, near Ludlow. This specimen must be compared with *A. marklini* and not the individual from the Wenlock Limestone of Dudley which Lake described when he redefined the species (1869, pl. vii. fig. 6). *A. marklini*, as I have already stated, was proposed by Angelin and later redefined by Lindström, who used the original specimen and additional material. The best-preserved cranidium of Lindström's types differs from *A. coronata* in having the eyes placed more posteriorly, a more rounded glabella, a sturdier occipital ring, and the cheek roll overhanging the posterior border. *A. marklini* is here considered to be different from *A. coronata*.

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† This is given by Lindström as the original type of Angelin's *A. multicuspis* which Lindström rejected as a synonym of *A. marklini* (1885, p. 54, pl. xvi. fig. 10). Dr. Warburg, in a written communication, expresses the opinion that this is not the case and that Angelin's type is lost.

PRIMASPIS R. & E. Richter, 1917.

Primaspis parallela, sp. n.

Only the cranidium is known, in which the posterior lateral portions have been pressed over the posterior border and furrow (Pl. IV. figs. 1 & 2, GSM: 55483 & 55484). Glabella is widest posteriorly, but subparallel for the greater part of its length; rises gently from the anterior border furrow to attain the highest point at the level of the postero-lateral lobes, thence descends at first gradually and later more suddenly into the occipital furrow. Central lobe is defined on either side by the sinuous longitudinal furrow; traced from the hinder extremity the lobe enlarges in breadth as far as the postero-lateral glabellar furrow, thence narrows to the antero-lateral lobes, beyond which it expands once more. The two pairs of lateral glabellar lobes are oval, approximately equal in size, and elongated axially. Occipital ring is about half as long as broad, and carries a small median tubercle or spine and a pair of divergent spines originating at the postero-lateral corners of the ring; the ring is devoid of lobes. Posterior border is tuberculated and overhung by the hinder part of the cheek roll, a relationship accentuated by crushing. Anterior border is short and feebly represented medially; laterally and immediately in front of the glabellar lobes it expands and forms a convex tuberculated area extending to the facial suture Fixed cheek is pointed anteriorly, enlarges as far as the palpebral lobe, immediately behind which it broadens rapidly at the same time turning under to meet the posterior border. Eye ridge is thin, provided with several prominent tubercles, and separated by a furrow from the fixed cheek with which it describes a parallel course. Posterior border and furrow well defined and sturdily proportioned. Facial sutures are convergent anteriorly, commencing on the frontal margin directly ahead of the lateral glabellar lobes, and approaching the eye ridges, which they follow to the eyes. Posterior branch is short, and turns outwards and downwards, making an angle of about 40° with the back margin of the cranidium. Eyes were situated near the level of the front of the postero-lateral lobes.

Geological Horizon and Locality.—Purple Shales of the Minsterley-Habberley lane 1/6 mile from the Shrewsbury main road.

Material.—Only one individual has been collected, and this is preserved as an internal cast and external mould.

Holotype.—GSM : 55483 & 55484.

Remarks.—*Acidaspis olini* (Troedsson, 1918, pp. 77 & 98, pl. i, fig. 29) from the Scanian Brachiopod Beds is the species nearest to *P. parallela* that I have yet seen, but although the general construction and proportions of the glabella and fixed cheeks are approximately the same, the antero-lateral expansions of the central lobe are more apparent, the occipital ring is not so well developed, and there are apparently no spines; the details of the facial suture are too obscure to warrant comparison. Of British species, the type which approaches *P. parallela* is *A. sladensis* from the Lower Valentian rocks of Haverfordwest (Reed, 1905, p. 100, pl. iv. figs. 8–11, SM: A 4644–4645; and 1907, p. 537), but this is a much smaller species, the glabella is subtriangular rather than nearly parallel-sided, and the lateral glabellar lobes do not show so marked an axial elongation. *Primaspis reperta* (Reed, 1925 *a*, p. 70, pl. ii. figs. 2 & 2 *a*), from the Middle Llandovery rocks of Newlands, recalls our species but differs noticeably in possessing a narrower fixed cheek, in the proportions of the occipital ring and the central lobe, and in the shape of the lateral glabellar lobes, which are inclined outwards.

Lichidæ Corda.

LICHAS Dalman, 1826.

Lichas constrictus, sp. n.

Cranidium is convex, measures 14 mm. long, and shows an interocular breadth of 13·5 mm. (Pl. IV. fig. 3, GSM: 55485). Central lobe of the glabella is convex longitudinally and transversely, and attains medially the greatest height of the head-shield; it is clavate, and expanded

in front to about four times the breadth at the base, the latter being taken along the basal glabellar furrow, which is clearly though faintly impressed. Front of the central lobe describes a regular curve, and its lateral extension is almost equal to the distance between the outer margins of the bicomposite lateral lobes. Longitudinal furrows commence in front of the bicomposite lobes, sweep inwards until near their base they diverge to form the neck of the central lobe, at the same time becoming so abruptly shallow that they are with difficulty followed as grooves vaguely defining the inner margins of the basal lateral lobes. Indicating the dual composition of the bicomposite lobes, the longitudinal furrows have a notch in their inner edge about midway along the length of the lobes. Posteriorly the central lobe is separated from the basal glabellar ring by means of the basal glabellar furrow. The bicomposite lobes are convex, elliptical, their major axis is directed at 30° to the median line, and they are about half as wide as long. They exhibit a constriction at their mid-length, and this may represent the second glabellar furrow, which has become obsolete except for these indentations. The quadrilateral basal lateral glabellar lobes are indefinitely outlined, but are obviously part of the basal glabellar segment for they are defined in front by the basal glabellar furrow, which curves forwards to meet the axial furrow. Preglabellar furrow is strongly curved and is easily traced laterally, being continued posteriorly as the axial furrow, from which branches inwards the longitudinal furrow. Axial furrow is sigmoidally curved, passes along the outer side of the bicomposite lobe, thence to the side of the basal lateral glabellar lobe, but its course across the occipital ring is unknown. Anterior border is gently inclined and narrow. Only a small area of the occipital segment is visible and there may be an occipital lobe, but this is too faintly indicated to be certain. Fixed cheek is convex, subtriangular, broadest opposite to basal glabellar lobes. From the palpebral lobe, which is on the level approximately of the middle of the bicomposite lobe, a shallow furrow runs forwards and inwards to join the axial furrow. Facial suture not definitely shown.

Geological Horizon and Locality.—Arenaceous Purple

Shales of the Bog Mine Outlier ½ mile N. 40° E. of Ritton Castle, Shelve.

Material.—One internal cast is available.

Holotype.—GSM : 55485.

Remarks.—The genotype of *Lichas* (s. s.) is *Lichas laciniatus*; there existed considerable confusion concerning the actual type, but Warburg has now refigured Wahlenburg's original (1925, p. 298, fig. 20) and is of the opinion that Angelin and others have mixed the pygidia of *L. laciniatus* and *L. affinis*. Phleger (1936, p. 599, fig. 3) has defined *Lichas* as "Lichadinae in which the longitudinal furrows end in notches at the third lateral furrows," and he has based this statement on Angelin's figure (1854, pl. xxxvi. fig. 1). Warburg (*op. cit.* p. 295, pl. viii. fig. 20) has figured an imperfect cephalon of *L. laciniatus* from Lissberg, and it is obvious from her description and figure that the longitudinal furrow does not possess this character, for the bicomposite lobes are clearly defined and the longitudinal furrow continues posteriorly to separate the basal lateral glabellar lobes from the neck of the central lobe. The Shropshire specimen shows a similar arrangement of parts to that seen in Warburg's figure of *L. laciniatus*, and thus it is placed also in *Lichas* (s. s.).

Platylichas grayi is the nearest British species to *L. constrictus* but differs in several characters (Fletcher, 1850, p. 237, pl. xxvii. fig. 8; and pl. xxvii. *bis*, figs. 3 *a*–*b*, GSM : 19522); the glabella is markedly convex longitudinally, possesses no notch indicating the bicomposite nature of the lateral lobes, central lobe is subparallel posteriorly instead of being divergent, lateral lobes are triangular and not oval, there is no furrow separating the basal glabellar segments, and the central lobe does not rapidly expand anteriorly. *L. constrictus* shows resemblances to the Swedish species *L. rotundifrons* (Angelin, 1854, p. 70, pl. xxxvi. figs. 7 *a*–*b*, holotype RM : Ar 2460), but the latter is characterized by a broader base to the central lobe, is much more rotund, bicomposite lobes are unconstricted and subtriangular instead of oval, palpebral lobe is placed more anteriorly, the central lobe is broadly expanded in front but shorter, there is no basal glabellar furrow, and the longitudinal furrows are nearly subparallel. The cephalon of *L. laciniatus* which has already been mentioned shows a close similarity to our species (Warburg, 1925, p. 295, pl. viii. fig. 20); the narrow base to the central lobe, its definition posteriorly by a shallow basal glabellar furrow, the shape of the bicomposite lobe, the shape and size of the basal lateral lobes, and the proportions of the clavate region are features present also in *L. constrictus*, but the two differ, since *L. laciniatus* has no constriction in the bicomposite lobes. *Platylichas grayi* var. *scotica* (Reed, 1906, p. 100, pl. xiv. figs. 5–10; and 1931, p. 17) and *P. grayi* var. ind. (Reed, 1906, p. 167, pl. xx. fig. 12) from the Valentian rocks of Girvan are superficially like *L. constrictus*, but both forms are much more convex and show a pronounced deflection of the glabellar front; also, in the former the neck of the central lobe is wide and the lateral lobes are more triangular, while in the undetermined variety the basal glabellar furrow is absent and the longitudinal furrows much less divergent.

Lichas marginatus Lindström.

1885. *Lichas marginatus* Lindström, p. 58, pl. xiv. figs. 8 & 9.
1906. *Lichas* (*Metopolichas*) aff. *marginatus* Reed, p. 104, pl. xiv. figs. 15 & 16.
1925 *a*. *Lichas* (*Autolichas ?*) *marginatus* Reed, p. 69.
1931. *Lichas* (*Autolichas ?*) aff. *marginatus* Reed, p. 18.
1935. *Lichas marginatus* Reed, p. 35.
1936. *Trimerolichas marginatus* Phleger, p. 604, fig. 15.

The only available specimen is a slightly distorted cranidium, and is an internal cast devoid of ornament (Pl. IV. fig. 4, GSM: 55486). Glabella is 13 mm. long and 15 mm. broad. Central lobe is clavate, almost as wide in its anterior expanse as the distance between the outer margins of the "bicomposite" lobes; posteriorly the lobe narrows to one-quarter of its anterior breadth due to the convergent longitudinal furrows, and then expands again at the level of the hinder margins of the "bicomposite" lobes where it reaches one half its anterior breadth. There is no transverse division of the neck of the central lobe by the basal glabellar furrow. So-called "bicomposite" lobes, which in this case are probably tricomposite, exhibit a smooth outline, are a little less than twice as long as broad, and are markedly convex both longitudinally and transversely. "Bicomposite" lobe reaches as far as the occipital furrow, which is deep, while the occipital ring and lobe are well developed. Longitudinal furrow subsemicircular, deeper anteriorly than posteriorly. Axial furrow is sigmoidal. Fixed cheek convex, subtriangular with apex directed forwards; merges on to the laterally protuberant palpebral lobe, which shows an anterior and a posterior ridge separated by grooves from an intervening lower triangular convex area. Anterior border is relatively broad, but it is incompletely preserved medially. Anterior facial suture sigmoidal, at first running horizontally inwards from the palpebral lobe, then curving through a right angle, bending outwards opposite the front of the " bicomposite " lobe, and finally trending inwards to cut the anterior margin 8·5 mm. from the mid-line. The posterior branch is invisible.

Geological Horizon and Locality.—Arenaceous Purple Shales of the Bog Mine Outlier ½ mile N. 40° E. of Ritton Castle, Shelve.

Material.—One internal cast which is slightly distorted.

Remarks.—The Shropshire specimen shows no important differences from Lindström's types of *L. marginatus* found in the Wenlockian deposits of Farö, Gotland (1885, p. 58, pl. xiv. figs. 8 & 9, RM : Ar 2367 & Ar 2366). The form named *Lichas* (*Metopolichas*) aff. *marginatus* from the Middle Valentian rocks of Girvan is practically identical with the Shropshire specimen, and although Reed states that the " fourth lateral lobes are almost obsolete," the specimen shows that they have entirely disappeared (1906, p. 105, pl. xiv. fig. 15, BM : In 22797). The glabella of *Lichas* (*Metopolichas* ?) *congruens* is also similar, but the occipital lobes are different in shape, there is no anterior border, and the bicomposite lobes do not attain the occipital furrow (Reed, 1935, p. 34, pl. iii. fig. 10).

Phleger has made *L. marginatus* the genotype of *Trimerolichas* (1936, p. 604, fig. 15), but instead of using as his illustration the type described by Lindström, he has copied the outline of the form which Reed is not certain is conspecific (1906, pl. xiv. fig. 15), and thus a false impression of the new genus might arise. There are doubts, however, regarding the validity of *Trimerolichas* either as a genus or subgenus, for the " wide brim on the anterior part of the cephalon " on which Phleger places considerable importance appears to me to be a minor character †, and, in addition, Warburg's interpretation of *L. laciniatus* (see p. 113) shows a close resemblance of this species to *L. marginatus*. The latter exhibits no basal lateral glabellar lobes, but in *L. laciniatus* the basal glabellar furrow is so shallow that a slight change might result in its loss with the consequent fusion of both lateral glabellar and bicomposite lobes. *L. laciniatus* seems to be so nearly related to *L. marginatus* that the latter is here included in *Lichas* (s. s.).

Lichas (s. l.) *norvegicus* Angelin.

1854. *Lichas norvegicus* Angelin, p. 73, pl. xxxviii. fig. 2.
1882. *Lichas norvegicus* Brøgger, p. 129.
1905. *Lichas* (*Metopolichas*) *laciniatus* Reed, p. 103.
1937. ? *Trimerolichas norvegicus* Warburg, pp. 212–217, figs. 1–4.

The only specimen is a pygidium, which is moderately well preserved in an olive-green mudstone (Pl. IV. fig. 5, GSM: 55487); it is slightly broader than long, measuring 32 by 27 mm. At about one-third the distance along the length of the pygidium the axis merges into the postaxial ridge, from which it is separated by a feebly defined furrow; axis is gently arched, occupies about one-third of the anterior breadth of the pygidium, tapers slightly posteriorly where it is bluntly terminated; two axial rings are present followed caudally by a third longer ring carrying a tubercle. Postaxial ridge is almost flat, expands posteriorly, and reaches back to the margin. Three pairs of pleuræ are developed, pleural and interpleural furrows being clearly defined. Two anterior pairs of pleuræ are foliaceous and prolonged laterally into acutely pointed free margins, while the third pair is directed backwards and situated on either side of the postaxial ridge; this latter pair appears to be squeezed out by the expanding base of the ridge before the periphery is attained, and thus the terminal bluntly pointed processes are not continuous with the third pair of pleuræ, but with the postaxial ridge. Doublure is broad, measuring 10 mm. across, and is crossed by a series of wavy discontinuous lines. Posterior pair of broad spines are ornamented by larger tubercles.

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† Since this was written I have received Dr. Warburg's paper on "Angelin's *Lichas norvegicus*—a Silurian species," in which the same opinion is expressed (1937, p. 214, footnote).

Geological Horizon and Locality.—Purple Shales of the Minsterley-Habberley lane 1/6 mile from the Shrewsbury main road.

Material. –One compressed specimen is known.

Remarks.—Before receiving Dr. Warburg's paper on *Lichas norvegicus* (1937, p. 212) I had referred the pygidium from Shropshire to the genus *Arctinurus.* Although Dr. Warburg is prepared to admit the similarity of the pygidium of *L. norvegicus* with that of *Arctinurus boltoni*, it is in the cephalon that important differences are manifest. As expressed elsewhere (see p. 115), I do not feel confident that *Trimerolichas* (Phleger, 1936, p. 604) will stand as a genus, and for the present I have placed *L. norvegicus* in *Lichas* (s. l.), and do not follow Warburg in placing it doubtfully in *Trimerolichas.* The specimens of *L. norvegicus* were mainly collected from Etage 6*cx* of Malmö; this horizon is probably a little lower in the succession than are the Valentian rocks of Shropshire.

The specimen from the Lower Valentian rocks of Haverfordwest is very crushed (Reed, 1905, p. 103, SM: A 4650), but the postaxial ridge is similar in exhibiting the pronounced posterior widening. *Lichas visbyensis* (Lindström, 1885, p. 58, pl. xvi. fig. 11, holotype RM: Ar 2419) has the same general appearance as *L. norvegicus*, but the pygidial axis is much more convex and broad, the postaxial ridge in its posterior extremity is not so expanded, and the first axial ring is followed by a median subsemicircular ring which does not extend across the axis †, whereas in our species a similar structure attains the axial furrow. Of British species, *L. norvegicus* is nearest *Dicranopeltis woodwardi* (Reed, 1903, p. 9, pl. i. figs. 7–8), but this form does not show the posterior widening of the postaxial ridge, it possesses a better-developed groove defining the posterior extremity of the axis, and has no tubercle. *D. barrandei* (Fletcher, 1850, p. 238, pl. xxvii. *bis*, fig. 5; and Reed, 1903, p. 10) is further removed for it shows more axial elements, has a parallel-sided and short postaxial ridge, and is different in shape.

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† Not visible in the holotype but in another specimen, RM: Ar 2392.

Encrinuridæ Angelin.

ENCRINURUS Emmrich, 1845.

Encrinurus onniensis, sp. n.

Excluding the terminal pygidial mucro the length of the largest syntype is 28 mm. and width 18·5 mm. (Pl. IV. fig. 6, GSM: 55488). In another syntype, cephalon is 18·5 mm. broad and 8·0 mm. in median length (Pl. IV. fig. 8, University Museum, Oxford). Glabella is pear-shaped, approximately as broad as long, and covered by coarse tubercles which are imperforate. Lateral margins show three tubercles with short intervening furrows; considerable controversy has existed as to whether such tubercles truly represent lobes (Reed, 1928, pp. 53–58); but if the casts of the Upper Valentian species here described are examined closely, it is found that there is a series of pits just on the inner side of the axial furrow, and these correspond in position to the grooves mentioned above (Pl. IV. fig. 9). There seems little doubt that the grooves represent the true glabellar furrows and the so-called tubercles can be interpreted as lobes. Basal glabellar segment reduced, smooth, and concave, and then follow anteriorly three lateral lobes; thus, excluding the occipital ring, there is evidence of four segments on the glabella. Occipital ring longitudinally and transversely convex with external nodular lobes; occipital furrow coalesced with basal glabellar furrow, but indicated laterally by a pit on the inner flank of the axial furrow. Axial furrow is wide and incised, and anteriorly swings outwards and is confluent with the antero-lateral border furrow which passes back to the intergenal angle, where it is joined by the posterior border furrow. Where the axial furrow is opposite the frontal lobe of the glabella it suddenly pitches down into the hypostomal pit, the under or ventral surface of which probably articulated with the antero-lateral wing of the hypostoma (see p. 120). Preglabellar furrow is extremely shallow, and in slightly compressed specimens the narrow preglabellar field, which carries eight pronounced tubercles arranged on an arc parallel with the furrow, may be confused with the glabella. The large outer tubercle on the preglabellar field overhangs the axial furrow and simulates a glabellar lobe, but it has no accompanying pit, such as the glabellar lobes possess, other than the deep hypostomal pit. Free cheek large, placed more in the vertical than in the horizontal plane; antero-lateral border furrow is broad, while the border is provided with a series of tubercles which decrease in size posteriorly. Facial suture originates in front of the genal angle and passes at first obliquely inwards and forwards, then sweeps almost parallel with the posterior border and so reaches the eye. The anterior branch describes a sigmoidal curve, traverses the axial furrow in front of the hypostomal pit, and swings upwards and forwards in front of the preglabellar field to make contact in the mid-line with the top of the rhomboidal rostral plate. Eye was obviously pedunculate, but precise details are lacking; eye is surrounded by a concave area showing a series of radiating ridges followed externally by a ring or areola of tubercles, of which those disposed nearer to the glabella are the larger. Fixed cheek is moderately developed, its surface mainly in the horizontal plane, and carries the intergenal spines, which extend at least to the sixth thoracic segment. Details of the palpebral lobe are unknown. Reference has already been made to the areola round the eye; the rest of the surface internal to the posterior border furrow is ornamented by small tubercles interspersed with shallow pits. Rostral plate, defined by the connective sutures, carries a tumid border, is rhomboidal in shape, the longer axis being placed vertically (Pl. IV. fig. 10). The tuberculation characteristic of the glabella is carried beyond the facial suture on to the free cheeks, and the upper half of the rostrum is held between this surface, while the lower half appears to be carried between the doublure.

Hypostoma is preserved as an external mould in juxtaposition with the doublure, its mid-line corresponding with that of the rostral plate (Pl. IV. fig. 7, GSM: 55489). Lindström (1901, p. 56, pl. iv. figs. 12–17) has figured the hypostoma in *E. punctatus*, *E. obtusus*, and *E. lævis*, and it is noteworthy that in *E. onniensis* the structure is different from any of these forms. The hypostoma and rostral plate promise to become much more reliable indices for the differentiation of species of *Encrinurus* than probably any other combination of characters. Hypostoma in our species is ornamented with punctæ, and shows a prominent tongue-shaped posterior mass. Anterior lateral wings comprise narrow, long, subtriangular extensions, and consequently have a large surface of contact with the doublure; this is one of the features by which the hypostoma differs from the species figured by Lindström. The specimen has been developed in order to show the relationship of the deep hypostomal pit, present on the axial furrow, to the underlying structures. The pit is seen on its ventral surface as a finger like process, and this is now known to articulate in a small socket at the inner end of the anterior wing of the hypostoma (Pl. IV. fig. 7). It is possible that muscles were attached to this process, and they may have had their other insertion around the socket. The direct articulation of the process with its socket on either side of the hypostoma would have made a hinge on which the hypostoma could have moved, activated by means of the muscles inserted as already described. The middle body in dorsal view is concave, shows faint indications of longitudinal trilobation with the median lobe extending forwards to the doublure, but, as far as can be ascertained, it does not project beyond as found in *E. obtusus* and *E. lævis*. The whole of the middle body is punctate; at its postero-lateral corners occur the maculæ, ovoid in shape, their longer axis inclined at about 45° to the median line, but further details are wanting. The trend of the anterior facial suture across the axial furrow but in front of the hypostomal pit should here be recalled.

Thorax consists of eleven segments (Pl. IV. figs. 6 & 8). Axial rings show little decrease in breadth posteriorly, and lateral nodular lobes are in evidence; the tenth segment carries a median tubercle. Pleuræ terminate in short blunt spines, and show an anterior and posterior pleural band separated by a wide furrow, but it should be remembered that the specimens are internal casts except for one example which is an external mould, and a plasticine squeeze of this shows that there is a convex central ridge on each pleura separating the anterior and posterior bands; thus the construction of the pleuræ seems to be different in the cast and the mould, due to the fact that the central band was solid and biconvex when sectioned transversely. The posterior bands are more longitudinally convex than are the anterior ones, which are provided with tubercles, an outer series near the fulcrum converging anteriorly towards the inner series placed alongside the axial furrow.

Pygidium is triangular and carries a mucro at least 4 mm. long (Pl. IV. figs. 6 & 8); one specimen referred to this species is non-mucronate, but in other respects it is in agreement (Pl. IV. fig. 11, GSM : 55490). Salter believed that the presence or absence of a mucro in otherwise identical forms was a feature of varietal importance, but I am disinclined to separate them varietally. In the mucronate forms there are at least twenty-two rings on the axis, and there are a few more than this number, but the furrows are indistinct; in the non-mucronate form at least twenty-one rings have been seen. In the internal cast the rings are incomplete after the second segment, but on the external mould they are complete up to and including the fifth or sixth segment, although the grooves defining them are deeper laterally than mesially. This difference, which is manifest in the cast and mould, has also been noticed in other species, and consequently the importance which some authors place on the number of complete rings may be overstressed. Single tubercles occur on certain rings, in the mucronate forms on 2, 6, 11, and 20, and in the bluntly terminated form on 2, 5, 8, 11, and 14, and also probably on more posterior segments. The position of the tubercles varies in different individuals, and their occurrence appears to be fortuitous. Number of pleuræ may be seven or eight, and they end in short bluntly spinose terminations. Axis is elongated and does not reach to the posterior end of the pygidium.

Geological Horizons and Localities.—Purple Shales of the Onny River Section near Cheney Longville and the arenaceous Purple Shales of the Bank Outlier near Minsterley.

Material.—Two almost complete specimens and a pygidium.

Syntypes.—GSM : 55488–55490 and specimen in the University Museum, Oxford.

Remarks.—Brünnich (1781, p. 394) described, but did not figure, a trilobite as "*Trilobus punctatus*, annulis corporis punctis per series transversim notatis"; this species has been incorrectly referred to *Encrinurus*. On writing to Dr. C. Poulsen regarding the loan of the two type pygidia which occur side by side on a "soft yellowish limestone from Bohemia," he replied that he had found these labelled by Brünnich as "*Trilobus punctatus* fragmenta impressa calcareo flavescente.—Bohemiæ," and that, as far as he could determine, "there is much probability that Brünnich's *Trilobus punctatus* and *Dalmanites hausmanni* (Brongn.) are synonymous." Having examined the specimens I concur with Dr. Poulsen's opinion, and consequently *Trilobus punctatus* should now be called *Dalmanites punctatus* (=*D. hausmanni*). Wahlenburg (1821, p. 32, pl. ii. figs. 1 & 1*) is frequently given as the author of *Encrinurus punctatus*, for he was the first to figure the pygidium as *Entomostracites punctata*; his type is in the Upsala Museum. But Wahlenburg's figure 1 is a cephalon of *Calymene*, and figure 1* the pygidium of an *Encrinurus*. Dalman (1826, p. 233, pl. ii. figs. 2 *a* & *b*) figured two specimens under *Calymene punctata* which are both referable to *Encrinurus*. Emmrich (1845, p. 42) apparently did not realise that Wahlenburg had confused the parts of two different animals under one specific name; Emmrich founded *Encrinurus* on account of the characteristic pygidium figured by Wahlenburg, which specimen thus becomes the holotype of *Encrinurus punctatus*. This species differs from *E. onniensis* in possessing twenty-six pygidial rings, and there are probably between five and ten additional rings which are indefinitely shown; it thus has half as many rings again as *E. onniensis* but the same number of pleuræ.

Encrinurus mullochensis Reed.

1878. *Encrinurus punctatus* var. *arenaceus* Nicholson & Etheridge, p. 109, pl. viii. fig. 2.
1888. *Encrinurus punctatus* var. *arenaceus* Marr & Nicholson, p. 668.
1906. *Encrinurus punctatus* Reed, p. 121.
1928. *Encrinurus punctatus* Reed, p. 64.
1931. *Encrinurus mullochensis* Reed, p. 19.

The type of this species is ill-preserved (BM: In 23175); it has suffered damage since Nicholson and Etheridge described and figured it, and unfortunately the figures are actually of little value for detailed comparison. Although Reed proposed the specific name, the form has never been fully described. The following account is founded mainly upon a perfectly preserved specimen (GSM : 55491).

Cephalon is a little more than half as long as broad (Pl. V. fig. 1); most individuals are small and delicately proportioned. Glabella is more pear-shaped than clavate. Occipital ring carries lateral nodular lobes, while the basal lateral glabellar lobes are small; occipital and basal glabellar furrows coalesce and constitute a strong groove separating the smooth occipital ring from the strongly tuberculated glabella. Three lateral glabellar lobes occur posterior to the shallow preglabellar furrow. Preglabellar field provided with nine tubercles, the extreme one on either side being markedly protuberant and simulating a glabellar lobe. Axial furrows diverge anteriorly, deep but not very wide; furrow passes facial suture and joins the antero-lateral border furrow and the furrow which limits that part of the glabella-like surface which has migrated on to the free cheeks. Free cheek (Pl. V. figs. 1 & 2), nearly vertically placed, extends inwards and round the front of the rostral plate, and carries in front of the glabella that convex tuberculated surface which can be likened to the glabellar continuation on the free cheek. Anterior border furrow strong, and the border itself is ornamented by a series of tubercles; the areola surrounding the eye is partly contained on the free cheek. Facial suture cuts the margin in advance of the intergenal angle, and swings inwards and slightly forwards to the eye; thence it passes forwards and still inwards towards the mid-line, traverses the axial furrow, rises abruptly on to the convex median mass of the cephalon, and follows the curve of the preglabellar region until the rostrum is attained. The eye was pedunculate. Fixed cheek is drawn up towards the eye. Posterior border furrow strong and bounded posteriorly by a convex border. Intergenal spines relatively short and extremely delicate (Pl. V. fig. 5, GSM : 55492), so that often they may not be preserved. Rostrum visible in front elevation and consists of an almost parallel-sided long plate held vertically between the free cheeks (Pl. V. figs. 3 & 4); .there is a short rostral suture.

There is no doubt that the plate has a different shape from that known in *E. onniensis*.

Hypostoma is poorly preserved (GSM: 55500), but the longitudinal median lobe of the middle body protrudes anteriorly.

Thorax consists of eleven segments. Axial rings carry articulatory half-ring and furrow, and also a pair of nodular lobes, axis tapers slightly posteriorly. Pleuræ exhibit a ridge delimited by the anterior and posterior bands, are bluntly terminated, and the fulcral point approaches nearer to the axis in successively posterior pleuræ.

Pygidium (Pl. V. fig. 4) shows a stumpy axis with about fifteen rings, tubercles being present on 1, 4, 7, and 10. Rings may be complete in some individuals or nearly so in others, but the grooves separating them are deeper at the sides than in the middle. Those rings which do not carry a median tubercle possess a series of at least seven minute tubercles. Pleuræ number eight, usually a tubercle at the fulcrum, and may have one or more between that point and the axial furrow. Posterior pair of pleuræ do not attain the margin and are characteristically V-shaped.

Geological Horizons and Localities.—Pentamerus Beds of Morrell's Wood and Harper's Dingle, near the Wrekin, and Wagbeach, near Minsterley; Purple Shales of Apedale, Onny River Section near Cheney Longville, and Plowden.

Material.—Eight moderately well-preserved specimens and eighteen pygidia.

Encrinurus shelvensis, sp. n.

Specimens are fairly common in the sandstones of the Bog Mine Outliers, but only cranidia and pygidia are known; they occur as internal casts and external moulds.

Cranidium is about twice as broad as long, the syntype being 27 mm. broad and 12·5 mm. long (Pl. V. fig. 6, GSM: 55493). The marked convexity and sturdy proportions of the glabella and the pygidium characterize this species. Glabella shows a pair of diminutive basal lobes, followed by three robust lateral lobes. Lateral glabellar furrows are represented by pits visible on the inner flank of the axial furrow. Just posterior to the facial suture where it cuts the axial furrow there is a pronounced hypostomal pit. Axial furrow deep and moderately wide; preglabellar furrow shallow. Preglabellar field with eight tubercles, of which the external one on each side overhangs the axial furrow. Occipital ring wide and short, with nodular lobes. Facial suture cuts the margin in advance of the intergenal angle, trends inwards and slightly forwards to the eye, after which it passes forwards and traverses the axial furrow, its course thereafter being obscure. Fixed cheek subtriangular, convex, provided with a row of at least four tubercles bordering the axial furrow, and with a strong posterior border. Intergenal angle bluntly terminated, there being no indication of intergenal spines in the available specimen.

Pygidium triangular and non-mucronate (Pl. V. fig. 7, BM: In 32531). At least twenty rings are present on the axis, and there may be ten more in a pygidium 14 mm. long, but in the specimens examined the preservation of the posterior tract is not good. Axis extends near to the end of the pygidium. As far as can be determined the rings are complete, and tubercles occur on 3, 6, 9 or 10, 13, 17, and 21. Pleuræ number eight or nine and end in blunt spines; along their inner portions the pleuræ carry tubercles, but these do not extend beyond the fulcrum.

Geological Horizons and Localities.—Pentamerus Beds 1100 feet, S. 15° E. of Barytes Mill, Wagbeach, near Minsterley; arenaceous Purple Shales of the Bog Mine Outliers.

Material.—Seventeen specimens comprising nine cranidia and eight pygidia.

Syntypes.—GSM: 55493 and BM: In 32531.

Encrinurus sp. ind.

One pygidium preserved with its test shows the details perfectly (Pl. V. fig. 8, GSM: 55494). Axis is almost conical and exhibits twenty-two completely divided rings of which 2, 5, 9 (?), 13, and 17 carry a median tubercle; rings without a median tubercle have a series of much smaller ones. There are eight pleuræ, of which the first six reach the margin; it is in the form of the remaining pleuræ that the erection of a new variety might be justified. Posterior extremity of the pygidium is non-mucronate, and the last pair of pleuræ grade into a strong tumid border; both pairs of pleuræ of the seventh and eighth segments originate from the sides of the axis, but the last pair curves together, meets, and is biconvex in outline. Between this eighth pair there is left a convex, triangular region, tapering posteriorly, which represents the ninth pleuræ which have not become differentiated. The biconvex shape of the eighth pair is simulated by the seventh, but not so completely. All the pleuræ are finely granulated.

Geological Horizon and Locality.—Pentamerus Beds, 1100 feet, S. 15° E. of Barytes Mill, Wagbeach, near Minsterley.

Phacopidæ Corda.

PHACOPS (s. s.) Emmrich, 1839.

The genus *Portlockia* is in a confused state, and several attempts have been made to clarify its position in nomenclature. McCoy erected *Portlockia* in 1846 (p. 50) with *P. sublævis* as the only species. Unfortunately, the type-specimen is no longer available, but Salter, who saw the original, thought that it was identical with *Phacops stokesi* (1864, p. 22) and did not recognize *Portlockia*, although McCoy continued to do so (1849, p. 399; and 1855, p. 162). In 1918 McLearn (p. 34) revived the genus with *Phacops stokesi* as the genotype, and later (1924, p. 170) used the name *Portlockia* in a manner accepted by Reed (1927, p. 340; and 1931, p. 23). In the meantime R. & E. Richter (1923, p. 135) expressed the opinion that *Portlockia* was invalid, since it is synonymous with *Phacops* (s. s.). Recently Delo (1935 *a*, p. 405) has proposed *Eophacops* to replace *Portlockia*. If the Richters be correct then *Eophacops* is unnecessary for *P. elegans* and *P. stokesi*, since these must be referred to *Phacops*. The genotype of *Eophacops* is *E. handwerki* (Weller, 1907, p. 271, pl. xxiv. figs. 6 & 7), but this appears also to fall into *Phacops*. The present author agrees with the Richters that *P. stokesi* can be placed in *Phacops* (s. s.), of which the genotype is *Phacops latifrons* Bronn as designated by Barrande (1852, p. 498).

Phacops elliptifrons (Esmark).

1927. *Phacops elliptifrons* Kummerow, p. 16, pl. i. figs. 9, *a* & *b*.
A synonymy is given in this publication, and to it may be added the following.
1878. *Phacops stokesi* Nicholson & Etheridge, p. 98.
1888. *Phacops elegans* Marr & Nicholson, p. 720, pl. xvi. figs. 1–3.
1906. *Phacops* (*Phacopidella*) *elegans* Reed, p. 154, pl. xix. figs. 19–23.
1927. *Phacops* (*Portlockia*) *elegans* Reed, p. 339.
1931. *Phacops* (*Portlockia*) *elegans* Reed, p. 23.

The best specimen shows the cephalon and pygidium disarticulated from the thorax, the contiguous elements slightly overlapping one another (Pl. V. fig. 9, GSM: 55501). The cephalon is 8·5 mm. broad (calculated) and 5·0 mm. long. Glabella expands anteriorly, increasing from a basal breadth of 2·0 mm. to a maximum of 4·5 mm.; in profile it describes a low convex curve which reaches its greatest elevation at the posterior end of the frontal lobe. Frontal lobe relatively large, transverse, extending forwards to constitute the front margin; posteriorly, it is defined laterally but not medially by the first glabellar furrows. First glabellar furrows shallow, almost horizontally disposed but slightly curved; second pair of furrows shallow, inclined backwards, and impersistent like the first pair in the middle third of the glabellar breadth. Third pair of furrows deep, converging forwards, and becoming shallower towards the centre, where they almost meet. Second glabellar lobes subrectangular and flat; third lobes rounded posteriorly; fourth glabellar lobes are nodular and marginal. Between the occipital and third glabellar furrows internal to the nodular lobes there is a flat triangular area lying at a lower level than the rest of the glabella, and this imparts a stalked appearance to the glabella as a whole. Occipital ring convex, elevated, about as high as the maximum height of the glabella, showing occipital lobes. Axial furrows deep, straight, including between them an angle of about 55°. Strong posterior border furrow on fixed cheek terminating at intergenal angle, which is rounded; surface of fixed cheek internal to the eye is subtriangular, moderately flat, inclined upwards from axial furrow to the protuberant crescentic palpebral lobe. Free cheek small and carries a lateral border furrow; when the shell is removed and the under surface exposed as a mould, a series of nodular ridges separated by narrow grooves transverse to the margin are visible. Marr and Nicholson (1888, p. 721, pl. xvi. fig. 3 *b*) saw such structures in *P. elegans* (=*P. elliptifrons*) from the Lake District, and thought that they were grooves into which fitted the terminations of the thoracic pleuræ when the animal was enrolled. Five such ridges, which represent open grooves in the actual test, have been noted, and doubtless there are more, but these could not be developed. Eye is semicircular, commences anteriorly in advance of the first glabellar furrow, and extends backwards to terminate at the front margin of the posterior border furrow. Visual surface is declined outwards and there are about 84 facets, usually polygonal in outline and frequently showing a central pit; the facets are radially arranged with a maximum of six per radius. Posterior branch of the facial suture is slightly curved, but extends almost horizontally outwards; anterior branch is ill-defined, but probably conforms in shape to the outer and front margins of the frontal lobe.

Thorax consists of eleven segments, but these are distorted through lateral compression, and the cephalon is disarticulated and partly overlies the anterior segments; these decrease in breadth posteriorly. Axial furrows clearly delimited; axial rings possess articulatory half-rings and show a nodular lobe at each lateral margin. Pleuræ overlapping external to fulcrum, which is placed at about one-third the total pleural breadth from the axial furrow. Pleural furrows pronounced, separating anterior and posterior convex bands.

Pygidium semicircular, partly overlapped on left side by the last thoracic segment; the pygidium is better preserved in the specimen from Gilberries Brook (Pl. V. fig. 10, GSM: 55495). Axis clearly outlined by furrows and bluntly terminated posteriorly. Anterior three axial rings and pleural pairs clearly defined, but posteriorly there is a suggestion only of an additional three rings with their attendant pleuræ. Axis and pleuræ all end at the strong doublure; there is no mucro. Anterior pair of pleuræ exhibit a fulcral point, but the others curve obliquely downwards.

Geological Horizons and Localities.—Abundant in the Pentamerus Beds of Morrell's Wood and Snead, and in the arenaceous Purple Shales of the Bog Mine Outliers; fairly characteristic of the Purple Shales of Apedale and of Middletown Hill (Breidden Hills).

Material.—All internal casts or external moulds, but in some cases a little of the test is preserved. Nine cranidia and two pygidia from the Pentamerus Beds, twelve cranidia from the arenaceous Purple Shales, and six complete individuals, two cranidia, and three pygidia from the Purple Shales.

Remarks.—Many specimens identified here as *P. elliptifrons* do not show the glabellar furrows on the internal cast, and, on first examination, these appear to represent a distinct variety. It has been ascertained, however, that the furrows are nearly always present in the external mould of such individuals, and thus their identity with the above species seems certain.

In 1833 Esmark (p. 269, pl. vii. figs. 6 & 7) described *Tril. elliptifrons* from Malmoekalven, Oslo Fjord; the beds are of Lower Valentian age and referable to Etage 6 (Kiaer, 1908, p. 594, pl. iii.). Boeck (1838, p. 138) separated Esmark's figure 7 on plate vii. as *Tril. elegans*, but gave no further description. At a much earlier date Brongniart (1822, p. 15, pl. i. figs. 4 & 5) proposed the species *Calymene macrophthalma*, but in 1840 Milne-Edwards (p. 324) referred Brongniart's fig. 5, A–C, to the new species *Calymene stokesi*. Boeck (1838, p. 139) had, however, already stated that Brongniart's figs. 5, A–C, were probably synonymous with *Tril. elegans*. Schmidt (1881, p. 73) remarks that Brøgger had mentioned in correspondence that he considered *P. elegans* to be identical with *P. elliptifrons*, but Schmidt was not in the position to investigate more closely this opinion. Esmark's two type-specimens of *P. elliptifrons* are lost; since one of these was selected by Boeck as the type of *P. elegans*, it is impossible to define nowadays the characters of this latter species, particularly as Esmark's figures are poor. I have been able to examine specimens of *P. elliptifrons* in the Oslo Museum, and although there is some variation in glabellar shape, yet it does not seem possible to pick out one clearly defined kind with an elliptical glabella and another with a trapezoidal glabella, which were the characters selected by Boeck respectively for *P. elliptifrons* and *P. elegans*. Consequently there appears to be no alternative but to discard this often used specific name of *P. elegans*.

DALMANITES Barrande, 1852.

Dalmanites weaveri (Salter) var. *tenuimucronata*, var. nov.

The most complete cephalon available is of a small form measuring 6 mm. long and 12 mm. broad (Pl. V. fig. 11, GSM : 55502); another larger but less complete specimen is 8·5 mm. long (Pl. V. fig. 12, GSM : 55496). These specimens are preserved in shale and may be compressed. Test is finely granulated, a feature seen better in external moulds (GSM : 55497). Glabella expands anteriorly, reaching a maximum breadth of 5 mm. across the frontal lobe; in profile it describes a low curve rising gently to its greatest height on the frontal lobe and gradually becomes lower posteriorly. Frontal lobe large, transverse, extends forwards to meet the front margin in the mid-line, there being no sign in this position of the border which is first visible in dorsal view only at the sides of the lobe. Postero-laterally the lobe is defined by the first glabellar furrows, diverging at an angle of about 120°, but the latter do not completely traverse the glabella, so that the frontal lobe is confluent with the median part of the glabella. In the mid-line and at two-thirds the length of the lobe from the anterior margin there is a pronounced pit. Second and third glabellar furrows horizontally disposed, each individual furrow traversing one-third the glabellar breadth and deepening at its external extremity. First lateral lobes subtriangular, while the second and third pairs are nodular. Occipital ring elevated above the level of the preceding part of the glabella, nodular laterally, and defined by the occipital furrow, which is deep from its junction with the axial furrow to a distance inwards of one-quarter the basal glabellar breadth; then becomes shallow and remains so for half the glabellar breadth before it descends abruptly into the corresponding incised tract on the opposite side. Axial furrow moderately deep, diverging from its fellow at an angle of about 25°, joins the first glabellar furrow at the greatest width of the glabella, at which point it swings inwards and forwards, disappearing in dorsal view underneath the frontal lobe. Surface of fixed cheek slightly convex, and antero-laterally it turns suddenly upwards to form the steep inner flank of the semilunar palpebral lobe. Posteriorly the cheek carries a pronounced posterior border furrow which can be followed to the intergenal angle; the specimen is here incomplete, but it seems probable that the posterior border was directed backwards as a small intergenal spine. Lateral border furrow joins the posterior border furrow, and can be followed forwards over the free cheek to where it coalesces with the axial furrow. Lateral border 0·5 mm. wide approximately, and is just seen to disappear under the frontal lobe; the doublure is markedly convex and about 0·5 mm. wide along the lateral margin. Free cheek is small; the eye is semicircular and raised above the level of the rest of the cephalon. It originates opposite the anterior end of the first glabellar lobe and trends backwards to terminate opposite the third glabellar lobe. Visual surface is almost vertical, but precise details of the facets are lacking. Antero-laterally the eye abuts against the lateral border furrow, but when traced posteriorly it swings inwards and away from this furrow leaving a smooth slightly convex interspace on the free cheek. Posterior branch of the facial suture passes almost directly outwards from the hinder end of the eye, while the ill-defined anterior branch leaves the eye to encircle the antero-lateral margins of the frontal lobe.

All the pygidia are isolated examples; the only other species of *Dalmanites* found in the fauna has a different pygidium, and this is associated in the same piece of rock with a characteristic cephalon (see p. 133). In all probability the pygidium now to be described can be relegated to the variety *tenuimucronata*. Pygidium (Pl. V. figs. 13 & 14, GSM: 55498 & 55499) is semi-oval, being 12 mm. broad and 10 mm. long, the latter measurement disregarding the mucro, which accounts for another 6 mm. Axis 4 mm. broad anteriorly and tapering at an angle of 35°; fifteen axial rings, of which the first carries an articulatory half-ring, can be discerned on the external mould. Deep furrows occupy one-third the axial breadth on either side, and each pair of furrows is connected across the median third of the axis by an open broad groove. There are seven pleuræ, which expand laterally up to their abutment against the inner margin of the doublure; six of the pleuræ definitely coincide with the anterior six rings. Rib furrows are narrow, clearly impressed, and define the first six pleuræ; pleural furrows are much broader and more open than the rib furrows, and, like them, extend to the doublure. The anterior two pleuræ, together with the rib and pleural furrows, extend at first horizontally and then are deflected obliquely downwards; succeeding pleuræ are directed posteriorly from their inception. Traced from the antero-lateral corners of the pygidium the pronounced doublure increases in breadth and is prolonged as a delicate spine, of which a length of 6 mm. is preserved. The whole of the pygidium is covered with a finely granulated ornament.

Geological Horizons and Localities.—Most characteristic of the Pentamerus Beds of the Wrekin District and Shineton; occasionally in the Purple Shales of Hughley Brook and Harley Brook.

Material.—One cranidium and six pygidia from the Pentamerus Beds, and one cephalon and two pygidia from the Purple Shales.

Syntypes.—GSM: 55496 to 55499 and 55502.

Remarks.—Delo (1935 *a*, pp. 404 & 410) has proposed the new family name of Dalmanitidæ, and this is placed with the Phacopidæ in the new superfamily Phacopidacea. I see no justification for this subdivision and have not adopted his classification.

Reed (1909, p. 73; and 1927, p. 341) refers *Phacops weaveri* to *Dalmanitina*, while McLearn (1924, p. 169), from his study of some distorted specimens from Arisaig, is of the opinion that the "species stands intermediate between *Dalmanitina* Reed and *Dalmanites* Barrande," and places it in *Dalmanites*. Reed (1909, p. 70) selected a specimen from the Upper Valentian of Long's Quarry in the Collection of the Geological Survey (GSM: 19221) as the type, but an artist's note at the foot of the drawing made by Bailey for the plate illustrating Salter's original description of the species (Salter, 1849, Dec. ii. pl. i. fig. 16) shows that the type comes from Long's Quarry, near Tortworth, the specimen being in the collection of the Geological Society. An examination of this latter collection, now largely housed in the Geological Survey Museum, shows that Salter's original is GSd 3154 and not 19221. Reed states that *P. weaveri* possesses no mucro, and since he dealt mainly with internal casts and external moulds, the former frequently not showing this structure, his failure to realise the presence of a short mucro can be understood. The type-specimen shows between thirteen and fifteen axial rings, which is a number more characteristic of *Dalmanites* than *Dalmanitina* (Delo, 1935 *a*, p. 411), while the former being a Silurian genus and the latter Ordovician suggests that *P. weaveri* is better referred to *Dalmanites.*

The material from Shropshire is closely related to *Dalmanites weaveri*, no difference being manifest in the cephalon, but the pygidium possesses a longer mucro, is more rounded, has clearly incised rib furrows, and the dorsal doublure is stronger. Such differences are here considered of minor importance, and the specimens are placed in a new variety of this species.

Dalmanites vulgaris (Salter), var.

The occurrence of an isolated cranidium and pygidium occurring side by side suggests that they are parts of the same individual (Pl. V. figs. 15 & 16, GSM : 55504 & 55503). The specimens agree in detail with the fossils named by Salter as *Phacops* (*Odontochile*) *caudatus* var. *vulgaris* (1849, Dec. ii. pl. i. figs. 1–12, and 1864, pl. iii. figs. 4–17), and the closest similarity is noticed with figure 5 in the later publication. The pygidium differs in the number of pleuræ, for Salter mentions that in his variety there may be between six and eight, while in our specimen there are ten. This may be a varietal difference, particularly as Salter notes that even in immature forms the number appears moderately constant. I have one incomplete pygidium available and so do not think that the erection of a new variety is justified.

Geological Horizons and Localities.—Pentamerus Beds of Shineton Brook and Purple Shales of Hughley Brook, and Onny River Section near Cheney Longville.

Material.—Three cranidia and one pygidium.

Remarks.—Delo (1935 *b*, p. 424) has recently stated that the genotype of *Dalmanites* is *Trilobus caudatus* Brünnich, which is a synonym of *Asaphus longicaudatus*

Murchison, and that *Asaphus caudatus* Brongniart is a different species identical with *Phacops caudatus* var. *vulgaris* Salter. It should be noted that half a century ago Lindström came to the same conclusions (1885, pp. 37–38) and was the first to propose that Salter's variety be raised to specific rank.

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VI. EXPLANATION OF THE PLATES.

Plate II.

Figs. 1–3.—*Illænus æmulus* Salter (see p. 89).

Fig. 1. Internal cast of cranidium, postero-lateral corners broken (GSM : 55462). *Fig.* 1 *a*. Longitudinal profile. All natural size. Pentamerus Beds at section by Ford, Morrell's Wood, near Leighton, 170 yds. W. of Morrell's Wood Farm.

Fig. 2. Internal cast of pygidium, holotype (GSM : 35991). *Fig.* 2 *a*. Transverse profile taken 13 mm. from the front of the pygidial axis. *Fig.* 2 *b*. Longitudinal profile. All natural size. Pentamerus Beds, probably of Norbury.

Fig. 3. Internal cast of pygidium (GSM : 55463) showing the test of the dorsal surface of the ventral doublure and the caudal fascia, × 1. *Fig.* 3 *a*. Caudal fascia magnified to show ridges and distribution of granules, × 5. Pentamerus Beds at section by Ford, Morrell's Wood, near Leighton, 170 yards W. of Morrell's Wood Farm.

Figs. 4–6.—*Illænus arenaceus*, sp. n. (see p. 92).

Fig. 4. Internal cast of cranidium, the palpebral lobe on the left side being incomplete, syntype (GSM : 55464), × 2½. *Fig.* 4 *a*. Longitudinal profile, × 2. Arenaceous Purple Shales of the Bank Outlier, near Minsterley.

Fig. 5. Internal cast of pygidium, syntype (GSM : 55466), × 2. Same locality and horizon as previous figure.

Fig. 6. Internal cast of pygidium with part of test intact, syntype (GSM : 55467), × 1·9. *Fig.* 6 *a*. Longitudinal profile, × 2. Pentamerus Beds, 1100 feet S. 15° E. of Barytes Mill, Wagbeach, near Minsterley.

Figs. 7–8.—*Illænus proles* Holm var. *shelvensis*, var. nov.
(see p. 93).

Fig. 7. Internal cast of incomplete cranidium, holotype (GSM : 55468), × 1. Arenaceous Purple Shales of The Napp Outlier, near Shelve.

Fig. 8. Internal cast of distorted cranidium, paratype (GSM : 55469), × 1. Purple Shales of the Minsterley–Habberley lane 1/6 mile from the Shrewsbury main road.

Plate III.

Figs. 1–3.—*Warburgella stokesi* (Murchison) (see p. 95).

Fig. 1. Almost complete specimen, neotype (no. 335, Ketley Collection, Birmingham University). The cephalon, which is slightly tilted forward, overlaps the anterior part of the thorax, × 2. Wenlock Limestone of Dudley, Staffordshire.

Fig. 2. Almost complete specimen, internal cast (GSM : 55470), × 2. *Fig.* 2 *a*. External mould of same individual, but illuminated to make it appear as an internal cast (GSM: 55471), ×1·9. Pentamerus Beds, Harper's Dingle, 1/6 mile N. of Spout Lane, near Little Wenlock.

Fig. 3. A nearly complete specimen which shows very clearly the rostrum (GSM: 35999 Wyatt Edgell Collection), ×3. Purple Shales of the Onny River Section, near Cheney Longville.

Fig. 4. *Warburgella binodosa*, sp. n. (see p. 97). Internal cast of the holotype (GSM: 36000 Wyatt Edgell Coll.), ×2. Purple Shales of the Onny River Section, near Cheney Longville.

Fig. 5. *Proetus* sp. ind. (see p. 98). Specimen with the test preserved (GSM: 55472). Found in a limestone band rich in *Barrandella linguifer* in the Purple Shales of the Minsterley–Habberley lane 1/6 mile from the Shrewsbury main road, ×2·1.

Fig. 6. *Otarion elegantula* (Lovén) (see p. 99). Internal cast of an almost complete cranidium (GSM: 55473), ×3½. Pentamerus Beds at the section by Ford, Morrell's Wood, near Leighton, 170 yds. W. of Morrell's Wood Farm.

Fig. 7. *Otarion megalops* (McCoy) (see p. 101). Plaster cast of the presumed holotype, National Museum of Ireland, Dublin, ×2·8. Note the furrows in front of the basal glabellar furrows.

Figs. 8–13.—*Leonaspis erinaceus* (Marr & Nicholson) var. *salopiensis*, var. nov. (see p. 103).

Fig. 8. External mould of an almost complete cephalon, syntype (GSM: 55474), ×3. Purple Shales of the Onny River Section, near Cheney Longville.

Fig. 9. Internal cast of a cranidium, syntype (GSM: 55476), ×3. Same locality and horizon as previous figure. The two areas shown in light tint indicate abraded parts of the specimen.

Fig. 10. Almost complete specimen, syntype (GSM: 55477), ×2. Same locality and horizon as previous specimen.

Fig. 11. Almost complete but distorted specimen, syntype (GSM: 55478), ×2. Purple Shales of the Minsterley-Habberley lane 1/6 mile from the Shrewsbury main road.

Fig. 12. Internal cast of a pygidium, syntype (GSM: 55479), ×2. Same locality and horizon as previous specimen.

Fig. 13. Internal cast of a pygidium, syntype (GSM: 55480), ×2. Purple Shales of the Gilberries Brook 1/12 mile N. of Wall–Longville road.

Fig. 14. *Leonaspis marklini* (Angelin) (see p. 108). Cranidium of a well-preserved specimen with test intact (GSM: 55482), ×2. Pentamerus Beds from a well 330 yards along the road east of Shineton Church.

PLATE IV.

Figs. 1–2.—*Primaspis parallela*, sp. n. (see p. 110).

Fig. 1. External mould of the holotype illuminated to appear as an internal cast (GSM: 55484), ×2. Purple Shales of the Minsterley-Habberley lane 1/6 mile from the Shrewsbury main road. Photographed under alcohol.

Fig. 2. Internal cast of the holotype (GSM: 55483), ×2.

Fig. 3. *Lichas constrictus*, sp. n. (see p. 111). Internal cast of the holotype (GSM: 55485), ×1·9. Arenaceous Purple Shales, Bog Mine Outlier, ½ mile N. 40° E. of Ritton Castle, Shelve.

Fig. 4. *Lichas marginatus* (Lindström) (see p. 114). Internal cast of a slightly distorted specimen (GSM: 55486), ×1. Same locality and horizon as previous specimen.

Fig. 5. *Lichas norvegicus* Angelin (see p. 116). A compressed pygidium in which the shell of a *Bilobites* has been pressed through the surface of the fossil near to the axis on the left side (GSM: 55487), ×1. Purple Shales of the Minsterley–Habberley lane 1/6 mile from the Shrewsbury main road.

Figs. 6–11.—*Encrinurus onniensis*, sp. n. (see p. 118).

Fig. 6. External mould illuminated to appear as an internal cast, syntype (GSM: 55488). Almost natural size. Purple Shales of the Onny River Section, near Cheney Longville.

Fig. 7. Hypostoma of the above-mentioned specimen seen on the internal cast, syntype (GSM: 55489), ×3¾. Note on the left the hypostomal pit (*h*) seen from below as a finger-like process inserted in a socket on the inner expanse of the anterior wing of the hypostoma.

Fig. 8. Internal cast, syntype (University Museum, Oxford), ×1 Same locality and horizon as previous specimen.

Fig. 9. Left-hand side of the glabella of the same specimen to show pits corresponding to the glabellar furrows, glabellar lobes (*g*), preglabellar furrow (*f*), tuberculated preglabellar field (*t*), and hypostomal pit (*h*), ×2.

Fig. 10. Front view of the same specimen to show the rostral plate outlined in white, ×5.

Fig. 11. Internal cast of pygidium, syntype (GSM: 55490), ×2. Arenaceous Purple Shales of the Bank Outlier near Minsterley.

PLATE V.

Figs. 1–5.—*Encrinurus mullochensis* Reed (see p. 122).

Fig. 1. Complete specimen seen at right angles to the cephalon (GSM: 55491), ×4·2. Purple Shales at junction of Harley Brook and Merrishaw stream, near Harley.

Fig. 2. Side view of the same specimen, ×4·6.

Fig. 3. Front view of the same specimen, rostral plate in white, ×4½.

Fig. 4. Same specimen seen at right angles to the pygidium. Part of rostral plate in white, ×4.

Fig. 5. External mould illuminated to appear as an internal cast; note delicate intergenal spine (GSM: 55492), ×2·1. Purple Shales, Harley Brook, near Domas, Harley.

Figs. 6–7.—*Encrinurus shelvensis*, sp. n. (see p. 124).

Fig. 6. Internal cast of cranidium, syntype (GSM: 55493), ×1. Arenaceous Purple Shales, Bog Mine Outlier, ¼ mile N. 40° E. of Ritton Castle, near Shelve.

Fig. 7. Internal cast of pygidium, syntype (BM: In 32531), ×2. Arenaceous Purple Shales near Minsterley.

Fig. 8. *Encrinurus* sp. ind. (see p. 125). Pygidium with the test preserved (GSM: 55494), ×1·8. Pentamerus Beds 1100 feet S. 15° E. of Barytes Mill, Wagbeach, near Minsterley.

Figs. 9–10.—*Phacops elliptifrons* (Esmark) (see p. 127).

Fig. 9. Almost complete but disarticulated specimen (GSM: 55501), ×2. Purple Shales of stream 450 yds. S.W. of Hughley Church.

Fig. 10. Pygidium (GSM: 55495), ×1·8. The actual specimen is nearly complete, but in order to show the characters of the pygidium the thorax and cephalon have been painted out. Purple Shales of the Gilberries Brook 1/12 mile N. of Wall-Longville Road.

Figs. 11–14.—*Dalmanites weaveri* (Salter) var. *tenuimucronata*, var. nov. (see p. 130).

Fig. 11. Nearly complete cephalon, broken and displaced on the left side external to the eye, syntype (GSM : 55502), × 2. Purple Shales of stream 450 yds. S.W. of Hughley Church.

Fig. 12. Incomplete cranidium (GSM : 55496), × 2. Pentamorus Beds at section by Ford, Morrell's Wood, near Leighton, 170 yds. W. of Morrell's Wood Farm.

Fig. 13. Internal cast of the pygidium (GSM : 55498), × 2. Purple Shales at junction of Harley Brook and stream by Merrishaw, Harley.

Fig. 14. External mould of the same specimen illuminated to appear as a cast (GSM : 55499), × 2.

Figs. 15–16.—*Dalmanites vulgaris* (Salter), var. (see p. 133).

Fig. 15. External mould of cephalon illuminated to appear as a cast (GSM : 55504), × 1. Pentamerus Beds, W. bank of Shineton Brook, 1000 yards S. of bridge on Shineton–Cressage road, S. of Shineton.

Fig. 16. Pygidium presumably of same individual as above (GSM : 55503), × 1. Same locality and horizon as previous specimen.

XIII.—*Five new Species of Ant, chiefly from New Guinea.* By Horace Donisthorpe, F.Z.S., F.R.E.S., etc., Department of Entomology, British Museum (Natural History).

PONERINÆ.

Acanthoponera plaumanni, sp. n.

☿. Reddish yellow, legs and scapes lighter, eyes, masticatory border and teeth of mandibles black ; whole body shining, and furnished with longer and shorter erect yellow hairs ; gaster clothed with rather long decumbent pubescence.

Head subquadrate, posterior border considerably emarginate, posterior angles thick with a blunt projection on each side ; sides of head to base of mandibles almost parallel. The sculpture consists of longitudinal raised ridges enclosing a network of large, shallow, shining pits. *Mandibles* large, with scattered shallow punctures, furnished with 8 or 9 rather small blunt teeth, except the two last apical ones which are longer, the one at apex being the longer and bluntly pointed ; *clypeus* convex and evenly arched, anterior border slightly emarginate in centre ; *frontal area* indistinct ; *frontal carinæ* slightly emarginate behind insertion of antennæ and then continued in a thin ridge to base of head, forming the upper side of a long, shallow, shining *scrobe* to receive the whole of the scape; *antennæ* moderate; *scape* not reaching posterior border of head by ⅓ of its length; *funiculus* with joints gradually increasing in length and breadth, forming a more or less 5-jointed club. *Thorax* narrowed to base; the sculpture on the dorsal surface and also on the sides of the pronotum is similar to that of the head, but the episternite and sternite of the mesothorax are smooth and shining with a few scattered shallow punctures; *pronotum* convex, broadest at anterior angles, which are rounded, and with a narrow neck in front for the reception of the head; *mesonotum* small, transverse, only slightly convex; *pro-mesonotal suture* semicircular, well marked; *meso-epinotal* suture only indicated by a furrow; *epinotum* with dorsal surface long, rather flat, furnished at base with two long, strong, projecting spines, which curve gradually, and very slightly inwards at apex; *declivity* abrupt, concave, smooth, shorter than the dorsal surface. *Petiole* armed above with a long sharp spine curving downwards, and beneath with a rounded projection ending posteriorly with a sharp tooth pointing backwards. The sculpture of the petiole is somewhat similar to that of head and thorax, only the apex of the spine and the projection beneath are very smooth and shining. *Gaster* covered with very small fine punctures, strangulation between *post-petiole* and rest of gaster considerable.

Long. 8·3 mm.

Described from a worker taken by Fritz Plaumann in Brazil, Nove Teutonia, lat. 27° 11′ 8″ S., long. 52° 23′ W., September 1935.

I have looked up the descriptions of all the known species to date. This very fine insect is much larger than any of the others.

The distribution of the genus is peculiar; it is found in Central and South America, Chili, East Australia, and New Zealand.

MYRMICINÆ.

Pheidole (*Pheidolacanthius*) *barumtaun* *, sp. n.

♃. Very dark brown, mandibles (except masticatory and basal borders, which are black), antennæ, apex of spines, clypeus, part of front and cheeks, epinotum, and parts of sides of thorax reddish, tarsi and articulations of the limbs yellowish. Whole body furnished with longer and shorter, scattered erect yellow hairs.

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* Barumtaun was the name of Miss Cheesman's camp.

Head subquadrate; *posterior border* very emarginate in centre, forming large side lobes with rounded posterior angles; with strongly raised longitudinal ridges anteriorly, straight and regular in the front, curving outwards at the sides with some of the interstices covered with very small raised tubercules; posterior part of head (lobes) closely concentrically striate. *Mandibles* massive, convex, smooth, and shining, with a few shallow scattered punctures; *masticatory margin* without teeth; *clypeus* raised in centre and with a carina, longitudinally striate at sides of anterior border, which is emarginate in centre; *frontal area* narrow, smooth, shining, rather deeply scooped out with rounded basal border, a narrow furrow extends to base of head, becoming much deeper between the lobes; *antennal carinæ* divergent posteriorly; *antennæ* short; *scape* not quite reaching the transverse striæ of the lobes of head; *funiculus* with last three joints slightly longer than the rest; *eyes* small, situated in front of centre of sides of head. *Thorax* smooth and shining; *pronotum* furnished with two long, strong, pointed spines projecting outwards, and slightly forwards at apex, a little longer than a third of the length of the thorax; *mesonotum* with a raised transverse carina with sharp

Fig. 1.

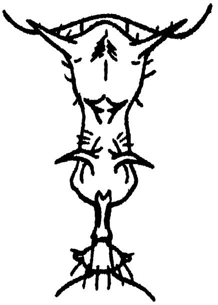

Fig. 2.

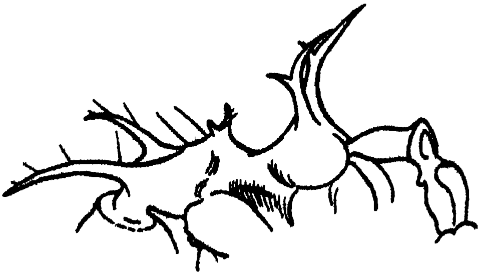

Fig. 1.—Dorsal view of thorax of soldier of *Pheidole (Pheidolacanthinus) barumtaun*, sp. n.

Fig. 2.—Lateral view of thorax of worker of *P. (P.) barumtaun*, sp. n.

small teeth at each corner; *epinotum* with two long spines projecting outwards and curving slightly backwards at apex, not as long as those of the pronotum, dorsal surface of epinotum slightly convex, *declivity* abrupt, of equal length to dorsal surface, slightly concave; *petiole* long and narrow anteriorly, with a thin, raised, rather high transverse projection posteriorly; *post-petiole* narrow, transverse, transversely striate, with a short projecting tooth at each side; *gaster* round, smooth, and shining.

Long. 6 mm.

☿. Colour and hairs much as in the ♃, only in some specimens the dark brown parts are nearly black. Very smooth and shining.

Head rounded in front and behind, posterior border margined; *mandibles* long, longitudinally striate, and with a few scattered punctures, masticatory border furnished with two long sharp teeth at apex, two shorter ones close to them, and one short tooth just before base, *clypeus* convex with a round projection before frontal area; *frontal area* shallow with well-marked side borders, rounded at base; *frontal carinæ* short, pointed at apex; *antennal foveæ* concentrically striate, *antennæ* long; *scape* extending beyond posterior border of head by nearly half its length; *funiculus* with last three joints about as long as the rest. *Thorax* narrow; *pronotum* armed with two long divergent spines, projecting forwards and curving slightly downwards at apex, about as long as two-thirds of the thorax; *mesonotum* armed with two short, erect acute spines; *epinotum* armed with two long curved spines, pointing backwards, not as long as those on the pronotum, with two short acute spines projecting upwards a little before the middle of the epinotal spines. *Petiole* long and narrow, raised to a projecting blunt ridge at apex; *post-petiole* broader than petiole, narrowed in front, dorsal surface round; *gaster* oval.

Long. 3·2 mm.

♂. Dirty pale yellow, head behind front and at sides of and behind eyes black, scutum of mesonotum and scutellum marked with blackish patches, sides of thorax and middle of femora and tibiæ brownish.

Typical *Pheidole* male; *ocelli* large, situated on a prominence at back of head; *mandibles* small, armed with two small sharp teeth; *Mayrian furrows* not very distinct. *Wings* iridiscent; one *discoidal cell*, one large and one small *cubital cell*, and a long closed *radial cell* present, *pterostigma* and *veins* yellow.

Long. 4·2 mm.

Described from eight soldiers, a number of workers, and four males, taken by Miss L. E. Cheesman in a nest in rotten wood on Mount Lina, Cyclops Mountains, Dutch New Guinea, 3500–4500 ft., March 1936.

Types in Brit. Mus. Coll.

This ant is quite distinct from all the other known species of this interesting subgenus.

It is perhaps as well to mention here that in my opinion *Pheidole* (*Pheidolacanthius*) *armata* Smith [Journ. Proc. Linn. Soc. Lond., Zool. viii. p. 75, pl. iv. fig. 8 (1864) sub *Pheidolacanthinus armata*] is the soldier and *P.* (*P.*) *quadrispinosa* Smith [Journ. Proc. Linn. Soc. Lond., Zool. viii. p. 72, pl. iv. fig. 6 (1864) sub *Myrmica quadrispinosa*] is the worker of the same species. Which being the case the former name will sink as a synonym. Professor G. Hale Carpenter has kindly lent both types to me, and both were taken by A. R. Wallace at Salwaty, New Guinea.

Smith also described his genus *Pheidolacanthinus* as having 11-jointed antennæ; whereas in the type-specimen they are 12-jointed.

Pheidole (*Pheidolacanthinus*) *elegans*, sp. n.

☿. Very dark brown, nearly black, mandibles, antennæ and tarsi yellow, femora and tibiæ light brown; very smooth and shining; a few scattered erect hairs are present, chiefly on the head, antennæ, and limbs.

Head rounded behind and narrowed in front; *clypeus* slightly convex, anterior border almost straight; *frontal area* very indistinct; *frontal carinæ* short, nearly parallel; *antennæ* moderate; *scape* extending beyond the posterior border of the head by barely the length of the first joint of the funiculus; *funiculus* with last three joints slightly longer than the rest. *Thorax* narrowed to base; *pronotum* armed with two long strong spines about a third as long as the thorax, projecting outwards and very slightly forwards; no *pro-mesonotal* suture; the *pronotum* and *mesonotum* when seen from above forming a diamond, the two upper sides (pronotum) being shorter than the two lower sides (mesonotum); the *mesonotum* ends in a raised angle; no *meso-epinotal suture*; the *epinotum* with its dorsal surface scooped out from this angle to base, where it is armed with two sharp divergent spines, shorter than those of the pronotum, curved slightly downwards at apex. *Petiole* long, narrow, terminating posteriorly in a narrow raised ridge; *post-petiole* round, convex, slightly broader than petiole; *gaster* small, somewhat oval.

Long. 2·2 mm.

Described from four workers, taken by Miss L. E. Cheesman, walking on a rubber tree, at Kokoda, Papua, 1200 ft., August 1933.

Type in Brit. Mus. Coll.

Fig. 3.

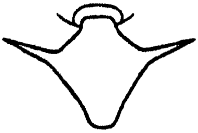

Fig. 4.

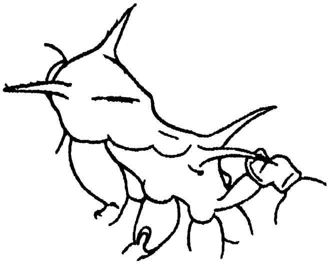

Fig. 3.—Dorsal view of front of thorax of worker of *Pheidole* (*Pheidolacanthinus*) *elegans*, sp. n.
Fig. 4.—Lateral view of thorax of worker of *P.* (*P.*) *elegans*, sp. n.

Podomyrma pulchellus, sp. n. (Figs. 5 & 6.)

The whole body very shining, black with an orange-coloured head, the mandibles darker with teeth black.

Head large, subquadrate, covered with strongly raised regular ridges, the interstices being smooth, posterior border margined and evenly emarginate; *mandibles* massive, strongly longitudinally striate and with small scattered punctures, armed with six strong teeth; *clypeus* large, flat, finely longitudinally striate; *frontal area* smooth, well defined; *frontal carinæ* divergent, arched, continued as one of the raised ridges on head; *eyes* large, round, prominent; *antennal fovea* deep; *antennæ* thick; *scape* curved, finely longitudinally striate and punctate, considerably broadest at apex, not reaching posterior angles of head by one-third of its length; *funiculus* with first joint as long as the two following taken together, gradually increasing in thickness to apex, last three joints pubescent. *Thorax* broadest in front covered with regular raised ridges, which are not as close as those of the head, interstices smooth; *pronotum* armed with two pointed spines projecting forwards and outwards; no *pro-mesonotal suture*; *mesonotum* separated from *epinotum* by a deep furrow; *epinotum* armed with two small teeth, which are wanting in some specimens; *petiole* long, armed at sides of base with two strong triangular teeth projecting outwards and a raised transverse ridge with sharp corners on centre of dorsal surface and a blunt tooth at base on under side pointing forwards; *post-petiole* broad, flattened in centre forming two lobes rounded at sides; *gaster* rounded in front, considerably narrowed to apex. *Legs* strong, femora considerably dilated in middle.

Fig. 5.

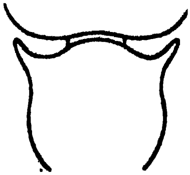

Fig. 6.

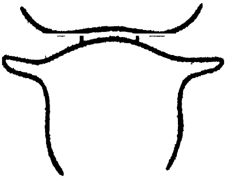

Fig. 5.—Front of thorax of worker of *Podomyrma pulchellus*, sp. n.
Fig. 6.—Front of thorax of worker of *Podomyrma ruficeps* Smith.

Long. 10–13·4 mm.

Described from seven workers taken by Miss L. E. Cheesman at Humbolt Bay, E. New Guinea, Mount Nomo, and Njan-limon, W. New Guinea, February and April 1936.

This beautiful species differs from *Podomyrma ruficeps* Smith [Journ. Proc. Linn. Soc. Lond., Zool. vii. p. 20 (1863)

Mysol] by the fact that the raised ridges on head and thorax are not interrupted by transverse net-work, by being more shining, and the clypeus less striate. The spines on the thorax project fowards, and not at right angles as in *nigriceps*, and are sharper. The epinotum being sometimes armed, the petiole is thicker and shorter and armed with teeth at the sides, and the dorsal surface is not armed with a small sharp projecting tooth; the post-petiole is broador, much smoother, and possesses two distinct lobes; the gaster is not longitudinally striate at base. From *P. dohertyi* Emery [Ann. Mus. Stor. Nat. Genova, xxxviii. p. 558 (1897), Moluccas] to which species judging by the description it appears to be nearest, chiefly by the importnat character of the spines of the pronotum projecting forwards; also by the epinotum sometimes armed, and the sculpture.

FORMICINÆ.

Polyrhachis (*Myrmothrinax*) *d'urvillei*, sp. n.

☿. Head, thorax, petiole, scapes of antennæ, palpi, and base of first six joints of funiculus dark brown; the last five joints of the funiculus and the last tarsal joints are yellow. Mandibles, clypeus, area between the frontal carinæ, insertion of the antennæ, legs, and gaster reddish brown, teeth black. Head, thorax, and petiole finely granulate, that of the petiole being slightly coarser; gaster shining, very finely reticulate transversely, and with very small scattered punctures, covered with very short, sparse, decumbent pubescence. The legs are very finely granulate and clothed with similar pubescence to that of the gaster. Some specimens are altogether lighter in colour; probably callows.

Head ovate, narrowed in front and rounded behind, broadest across the centre of the eyes; *mandibles* very finely longitudinally striate, and with very small, shallow, scattered punctures, armed with four strong sharp teeth; *clypeus* large, somewhat convex, with a strong central carina, neatly notched at centre of anterior border, which is somewhat advanced, with a rather sharp small tooth at each corner; *frontal area* not very distinctly defined behind; *frontal carinæ* with high sharp edges, emarginate in centre and slightly narrowed behind;

frontal furrow very shallow, but distinct, reaching to nearly the base of the carinæ; *antennæ* long; *scapes* extending over about two-thirds of the mesonotum; *eyes* round, prominent. *Thorax* margined, narrowed to base; *pronotum* narrowed in front, broadest at shoulders, which are distinctly dentate; *pro-mesonotal suture* deep and well defined; *meso-epinotal* distinct, but not so deep; *epinotum* armed with two strong, sharp, projecting subparallel spines, dorsal surface somewhat concave; *declivity* abrupt and also concave; *petiole* armed with three sharp spines, of which the centre one is considerably the longest, the two side ones very slightly curved inwards. *Gaster* moderate. *Legs* long.

Long. 6 mm.

♀. Colour as in ☿, sculpture stronger, longitudinally striate on *mesothorax* and *scutellum*; *pronotum* with shoulders entirely rounded; *epinotal spines* short, thick, and slightly curved inwards; *spines of petiole* thicker in proportion to those of the ☿ and the centre one not so much longer than the side ones. *Wings* yellowish; *pterostigma* and *veins* brownish yellow.

Long. 10 mm.

☿ and ♀ type in the Brit. Mus. Coll.

Described from a number of workers and two winged females taken with a woven nest on a leaf by Miss L. E. Cheesman in New Guinea; sea-level, Hollandia, Humbolt Bay, April 1936.

Named after Dumont d'Urville, who was the first to anchor (in the ship 'L'Astrolabe') in Humbolt Bay, and named the Cyclops mountains.

XIV.—*A new Species of* Polychœrus *from the Pacific Coast.* By Helen Miller Costello and Donald Paul Costello. (From the Hopkins Marine Station of Stanford University and the Zoology Department of the University of North Carolina.)

In 1892 E. L. Mark described *Polychœrus caudatus*, an acœlous turbellarian from the New England Coast, and for the past forty-five years no other representative of this interesting genus has been described. While collecting at Pescadero Point on Carmel Bay, California, in the summer of 1936, an enormous number of small orange-coloured flatworms were observed literally covering the bottom of certain tide-pools. Examination of these animals revealed a great resemblance to *Polychœrus caudatus* Mark, as described by Mark (1892), Verrill (1893), Gardiner (1895, 1898), and Löhner (1910). Yet there are a number of features, both external and internal, which appear to distinguish this organism as a new species of the genus *Polychœrus.* This species we shall designate as *Polychœrus carmelensis*, sp. n.

In general form the resemblance of *P. carmelensis* to *P. caudatus* is striking. Both species are rounded or slightly pointed at the anterior end, the sides parallel or slightly concave, the posterior end blunt and deeply notched, with a dorsal contractile filament arising medially from the notch. Both possess a high degree of flexibility of form. The internal structure of the two is, in general, similar. The diagnostic features of the genus *Polychœrus* (von Graff, 1905), namely, the possession of a bursa with numerous "chitinous mouth-pieces" and the presence of a pair of female gonads, each consisting of a germarium and vitellarium, are exhibited by the new species.

Among the characteristics in which the two species differ are the following :—(1) size ; (2) typical number of caudal filaments ; (3) the presence of surface papillæ ; (4) colour—the nature and distribution of the pigment-granules ; (5) the presence of eye-spots ; (6) certain characteristics of the female reproductive system—namely, the shape and size of the external female aperture, the structure of the vagina, and the structure of the gonads ; (7) the chromosome number ; and (8) the reaction to light. These differences we shall set forth briefly in this preliminary note, pending the publication of a complete description of the species.

1. *Polychœrus carmelensis* exceeds the dimensions of *P. caudatus* given by Mark (length 3·5–4 mm.), by Verrill (length 3–4 mm., width 1·5–2 mm.), and by von Graff, 1905 (length 5 mm.). The average size of adults of *P. carmelensis* in locomotion is 5·5–6 mm. in length and 1·5–2 mm. in width ; adults at rest measure usually 4–5 mm. in length, 2 mm. in width. The maximum

dimensions recorded for *P. carmelensis* are 7 mm. in length by 2·5 mm. in width, and 8 mm. in length by 2 mm. in width.

2. *P. carmelensis* possesses normally only one caudal filament. In the case of *P. caudatus* Mark found, not infrequently, individuals with an extra pair of caudal filaments placed symmetrically, one on either side of the usual median filament. Individuals with two caudal filaments, one median, one lateral, were equally common. Verrill described the number of filaments as varying from one to five, in adults "generally three." Among hundreds of individuals of *P. carmelensis* observed, from collections made at different times from three different localities, only a few specimens possessing more than one filament have been observed. These individuals possessed only one extra filament, lateral to the normal median filament.

3. The presence of small surface papillæ in *P. carmelensis* further distinguishes this species from *P. caudatus*. These papillæ are readily observable in the living animals, both larval and adult, and also have been found in the sections of preserved specimens. The papillæ are of about the same length as the cilia, but are of considerably greater thickness. They are located on the ventral surface of the body. They appear to be slightly more numerous at the anterior end than along the sides, but occur in very great numbers on the margins of the caudal lobes. Such structures have not been recorded in descriptions of the living *P. caudatus*, and it is doubtful at present as to whether they may be identified with any type of gland or surface structure which has been described in accounts of sectioned material of that species.

4. The colour of *P. carmelensis* may be described as typically deep orange, varying from pale ivory to red-orange. The brick-red colour described by Mark as characteristic of *P. caudatus* has not been observed in *P. carmelensis*. As in the case of *P. caudatus* the posterior half of the body is most intensely coloured, while the anterior third, margins, and posterior portion of the caudal lobes are translucent. There are present in both species two kinds of pigment-granules, each kind arranged in the form of irregular, more or less discrete bodies,

located in the body-wall and absent from the caudal filament. In *P. caudatus*, however, the two kinds of pigment-granules are yellow and purple, the latter being absent from the ventral wall, whereas in *P. carmelensis* the two kinds are yellow and orange, and both are found in both ventral and dorsal walls, but are far more numerous in the dorsal wall. The presence of orange rather than purple pigment, in combination with yellow, probably accounts for the orange rather than the brick-red external coloration of *P. carmelensis*.

5. Eye-spots, completely lacking in *P. caudatus* according to Mark and Löhner, are present in *P. carmelensis* in both young and adult individuals. They vary in size, shape, and number, but are invariably located in the region of the lateral ganglia or anterior nerve-trunks, approximately equidistant from the statocyst. They are roughly triangular or elliptical in surface view. The long axis of the eye-spot measures 30–60 μ, and is directed antero-laterally; the widest part varies from 10–30 μ, and is usually nearer the median than the lateral margin. There are commonly two eye-spots, but as many as six have been observed in a single specimen, with usually an unequal number on the two sides. The eye-spots are composed of orange granules which appear to be smaller than those found in the pigment-bodies of the integument.

6. The female reproductive systems of *P. carmelensis* and of *P. caudatus* exhibit several structural differences. The external orifices differ in size and shape. That of *P. carmelensis*, in living animals at rest as well as in preserved specimens, is transversely elliptical and measures about one-sixth of the width of the body. It is about twice the width of the mouth, and, like the mouth, is capable of great distention. The female orifice of *P. caudatus* is described by Verrill as "small, round . . . usually not very distinct," is thus figured by Mark, and is described by Löhner simply as "round." The vagina of *P. caudatus* (Mark, Verrill, and Löhner) is a simple ciliated tube which runs from the female orifice directly dorsally beneath the bursa. The length of the vagina, according to Mark, is one-half the thickness of the body in this region. In *P. carmelensis* the vagina is flattened in an antero-posterior direction, its dorsal

half lacks ciliation, and it extends dorsally about two-thirds of the thickness of the body in this region. Extending anteriorly from the vagina there is a thick-walled cylindrical pocket, which runs not quite parallel to the ventral surface of the body but slants slightly dorsally. Anteriorly it penetrates the dorsal wall of the bursa and posteriorly it opens into the vagina at a point about midway between the female orifice and the dorsal end of the vagina. In the living animal this pocket is visible as a relatively translucent area anterior to the female aperture.

There appears to be some difference in the structure of the female gonads of the two species. In *P. carmelensis* they are composite structures. There are two lateral ventral rows of ova, not enclosed in a specialized wall but merely embedded in the body parenchyma. They extend anteriorly nearly to the statocyst and posteriorly they become continuous with the two vitellaria. Each vitellarium extends from the region of the mouth posteriorly to the level of the female aperture. Anteriorly the two rows of ova bend medially and dorsally as they approach the region of the statocyst, where they appear to originate in a small medially located body. This body may be the equivalent of the "Eilager" as described by von Graff (1905) for certain other species. The smallest ova are located anteriorly, and there is a progressive increase in size as they pass posteriorly. There are, then, three distinguishable regions in the female gonads of *P. carmelensis*—the "Eilager," in which the eggs appear to originate; the region of previtelline growth, which consists of the two lateral rows of eggs; and the vitellaria, in which the eggs acquire yolk, undergo the maturation divisions, and are fertilized. An "Eilager" has not been described for *P. caudatus*, and its presence in *P. carmelensis* may constitute another difference between the two species.

7. Of considerable interest is the fact that the chromosome number of *P. carmelensis* differs from that recorded for *P. caudatus*. Gardiner (1898) found 31 metaphase chromosomes on the giant spindles of unlaid fertilized eggs of *P. caudatus*. There are 34 chromosomes in *P. carmelensis*. Counts have been made of metaphase

chromosomes on the giant spindles of unlaid and laid fertilized eggs, and of macromeres and micromeres of early cleavage stages. In favourable preparations 34 chromosomes can be counted with certainty and ease. We have also counted 17 chromosomes in the egg at early metaphase of the first maturation division. Gardiner did not record the haploid number of chromosomes for *P. caudatus*. We consider that an odd diploid number of chromosomes (31) is highly improbable for a hermaphroditic organism. It seems possible that Gardiner may have been in error in his observation of the diploid number of chromosomes of *P. caudatus*.

8. Mark observed *P. caudatus* in large numbers on the under sides of old *Pecten* valves off Naushon Island, Massachusetts, and Gardiner (1895) recorded that the animals accumulated on the sides of dishes away from the light in the laboratory. This suggests that *P. caudatus* is negatively phototropic to mild light intensities. In fact Löhner, in reporting that *P. caudatus* is found on the under surfaces of mussel shells and large stones, refers to the species as eyeless and negatively phototropic. *P. carmelensis*, on the other hand, appears to be positively phototropic to moderate light intensities. This reaction is indicated by the fact that, in the tide-pools at Pescadero Point, Point Pinos, and Point Lobos, California, *P. carmelensis* is found on the upper surface of *Ulva* and on the upper, not the under, surfaces of small stones and shells; also in the laboratory the animals tend to distribute themselves in larger numbers on the glass sides of the aquarium nearest the light. This reaction of *P. carmelensis*, differing from that of *P. caudatus*, may possibly be correlated with the nature of the pigment-granules and with the presence of eye-spots.

We have not as yet had the opportunity to examine *P. caudatus* from the New England Coast. It seems unreasonable to suppose that the investigators of *P. caudatus* could have overlooked or described erroneously all of the structures which we have listed above as the distinguishing features of the Pacific Coast form. We therefore feel justified in considering this form a separate species.

Von Graff (1911) reported that Dr. C. M. Child, in a personal communication, stated that *Polychœrus caudatus* had been found on the Pacific Coast at the Hopkins Seaside Laboratory *. Dr. Harold Heath (personal communication, 1936) found, in 1898 and on several subsequent occasions, while working at Pacific Grove, a form which he considered to be *Polychœrus caudatus*. It is probable that the Pacific Coast form reported as *P. caudatus* is the species with which we are here dealing, namely, *Polychœrus carmelensis*.

The following brief description will serve to distinguish this species from other known forms :—

Polychœrus carmelensis, sp. n.

Form like *Polychœrus caudatus*.

Caudal filament usually one, infrequently two.

Length, average 5·5–6 mm., maximum 8 mm.

Breadth, average 1·5–2 mm., maximum 2·5 mm.

Papillæ on ventral surface, especially numerous on caudal lobes.

Colour typically deep orange; pigment of two kinds, yellow and orange.

Eye-spots two or more, composed of small orange granules, located dorsally in the region of the lateral ganglia.

Female genital aperture elliptical, one-sixth of the width of the body.

Vagina antero-posteriorly flattened, extending dorsally two-thirds of the width of the body, with a short pocket extending anteriorly from its mid-region.

Female gonads composite, mostly ventral; consisting of (1) an "Eilager," just posterior to the statocyst, (2) two lateral ventral rows of ova extending posteriorly to the level of the mouth, and continuous with (3) the vitellaria, which terminate at the level of the female aperture.

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* Stevens and Boring (Journ. Exp. Zool ii. p. 335, 1905) and Child (Arch. f. Entwickl. xxiii p. 227, 1907) used the Pacific Coast form for regeneration experiments. Keil (Biol. Bull. lvii. p. 225, 1929) reported that Child had observed slight differences in ganglionic distribution between the Woods Hole and the Pacific Grove forms, and had suggested the possibility of a species difference.

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XV.—*Burrowing Methods of* Talorchestia deshayesii (*Audouin*) (*Crustacea, Amphipoda*). By D. M. REID, Department of Biology, Harrow School.

TALORCHESTIA DESHAYESII normally lives amongst the decaying algæ lying along high-water mark on a sandy beach. However, it not infrequently burrows into the sand, especially if there is no algal deposit to afford it shelter and food.

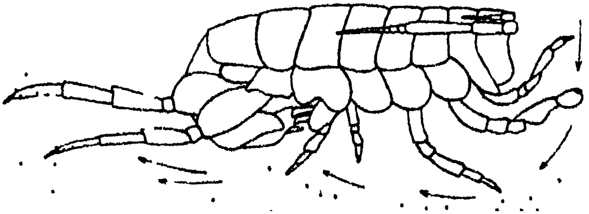
On such an alga-free beach the presence of this amphipod may be recognized by the surface of the sand being thrown up into a great number of small heaps of loose sand. The arrangement of these heaps seems to indicate that the amphipods tend to live in rather indefinite colonies near high-water mark. On removing the sand it was found that the organisms had penetrated to a depth of 2–3 inches. At this depth they were just in the zone of dampness, the surface of the sand being powdery dry.

A large number of specimens were collected in a bottle full of sand, and allowed a few hours to settle down. At the end of that time a number of individuals had burrowed out to the glass, where, with the aid of a lens, their actions could be observed.

The general position of the amphipod in the burrow can be seen in the sketch. The body is more or less horizontal, with the urosome strongly flexed. The antennæ are laid backwards along the sides of the body, so as to offer no obstruction to forward movement.

The first two pairs of limbs (gnathopods 1 and 2) are used to pull down or dig out the sand from in front of the animal. This sand tends to gather below the head, but it is removed simultaneously by the sweeping action of the first pair of peræopods. Thus it is thrown into a heap below the flexed urosome. All three pairs of limbs, then, are working rhythmically.

The next two pairs of peræopods (2 and 3) take no active part in the work. They are braced out sideways, and afford support to the animal and leave a clear passage for the sand. It is interesting to note that these limbs are very short, and are admirably adapted for giving support in this position.



Position of *Talorchestia deshayesii* in burrow.

The last two pairs (4 and 5) of peræopods act as pushers. They are stretched out behind, so as to push the animal forward as the sand in front is removed.

A pile of sand having accumulated under the urosome, the latter is extended with considerable force, in the process striking the pile of sand and flinging it well behind the animal. Peræopods 4 and 5 then take up a new position in this sand, and the urosome is reflexed. Of course the word "burrow" applied to this type of excavation is a misnomer. There is no open burrow after the animal has descended so far as to be unable to pitch the sand out of the opening. There is, in fact, a cavity only slightly longer than the animal. It is, however, high enough and wide enough to permit of turning movements. The rate of digging could not be estimated with any degree of accuracy, since the operation was so often interrupted for the minute examination of probable food-particles.

It is worthy of note that though *T. deshayesii* is a burrowing form its limbs are not furnished with the long setæ usually associated with this habit.

The specimens described were collected on a sandy beach on the north coast of Rhu Stoer, Sutherlandshire, in August.

XVI.—*A further Note on the Excretory System of* Maritrema *Nicoll*, 1907 (*Trematoda*). By Miriam Rothschild.

It has been possible to check the account previously given (Rothschild *, 1937) of the excretory system of the metacercariæ of *Maritrema* by examining a closely related and undescribed species of the "Oocysta" group of cercariæ found in *Peringia ulvæ* (Pennant, 1777) from St. John's Lake, Plymouth.

In this species no difficulty whatsoever is experienced in tracing the excretory system, and the count of the flame-cells, the course of their ducts, and the collecting tubes has been verified several times. It agrees in every detail with the description referred to above. The excretory bladder (see figure), however, shows some small structural differences. A slight constriction is present at the point of insertion of the two "arms" of the Y. There is another constriction at the base of the stem of the Y, at about the posteroir third of the bladder, giving the stem a "waisted" appearance. The terminal excretory pore is connected with the excretory bladder by a very narrow duct. What appears to be an elaborate sphincter muscle is situated between the stem of the bladder and this duct.

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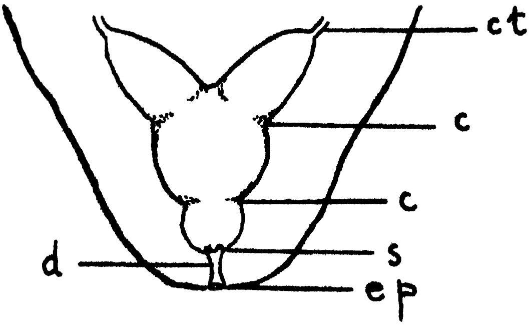
* The suggestions for the classification of the Microphallidæ Travassos, 1920, principally based on the morphology of the excretory system and tentatively put forward in this paper, are supported by D. B. McMullen (1937) in a subsequent publication then in press.

An interesting feature of this cercaria is the exceedingly poor development of the cystogenous glands. The cyst is spherical, formed of one layer only, and is of the flimsiest texture. Encystment, however, does not seem to take place invariably, as fully developed metacercariæ appeared free in the sporocysts.

Attention has previously been drawn (Rothschild, 1937) to the fact that variation in the life-cycle is shown within the genus *Maritrema*. A second intermediate host may be required, or encystment may take place in the first host. A dimorphic species is also known.



Excretory bladder of cercaria.

c, constriction ; *ct*, collecting tube ; *d*, duct leading to excretory pore ; *ep*, excretory pore ; *s*, sphincter muscle.

In the species recorded here a further modification appears to be taking place in the life-cycle, and the power of encystment is being lost or dispensed with. In the related family Lecithodendriidæ Odhner, 1910, free or unencysted metacercariæ are sometimes encountered as a phase of the normal life-cycle.

Acknowledgment.

I owe my best thanks to my assistant Miss G. R. Italiener for the discovery of this species.

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XVII.—*Eine neue Limacodide von Uganda* (*Lep.*).

Von Martin Hering (Berlin).

Durch die Liebenswürdigkeit von Sir Guy A. K. Marshall, Director des Imperial Institute of Entomology, erhielt ich eine *Parasa*-Art zur Bearbeitung, die auf den ersten Blick sehr stark der *P. hexamitobalia* Tams, 1930 (ebenfalls von Uganda kommend) ähnelt, sich aber sogleich durch das Fehlen der dunklen Mittellängslinie auf dem grünen Thoraxrücken und das Fehlen des gegen die Querader im Vorderflügel gerichteten Vorsprunges des dunklen Saumbandes im Aderwinkel 7–8 unterscheiden lässt. Sie sei nachfolgend beschrieben.

Parasa prava, sp. n.

♂♀. Kopf mit grünem, unterseits braunem Stirnbusch, Palpen dunkel gelbbraun. Thorax oben grün, unten violettbraun, so auch die Farbe der Beinhaare. Bei der verglichenen Art sind die Patagia am Ende violettbraun, hier einfarbig grün. Tegulæ-Enden mit braunem Fleck. Hinterleib wie bei *B. hexamitobalia* Tams, lehmgelblich, mit violettbrauner Längslinie auf dem Dorsum. Flügel dunkelgrün, mit schmalem, violettbraunen Saumband, das mit dem nach hinten und aussen schrägen violettbraunen Wurzelfeld am Hinterrande des Flügels zusammenhängt. Auf der Discoïdalquerader liegt ein rötlichbrauner Strich. Die weiteren Unterschiede gegenüber der verglichenen Art sind: Der Vorsprung des Wurzelfeldes auf dem Hinterrand der Zelle und Ader 2 ist weniger ausgesprochen, der dunkler grüne Fleck distal davon ist weniger ausgeprägt und kleiner, reicht nur etwa bis zur Mitte des grünen Feldes zwischen Wurzel- und Saumfeld. Das dunkle Saumband ist schmäler und erreicht nirgends die Mitte der von der Zelle ausgehenden freien Aderäste. Die Basallinie der Fransen ist weniger auffallend gelb. Hinterflügel bleich strohgelb beim ♂, beim ♀ nur eine etwa 1 mm. breite Randzone braun bestäubt, bei der Art von Tams ist diese viel breiter. Unterseite beim ♂ grün, heller als oben, Flügelaussenränder ganz schmal, höchstens 1 mm. breit, violettbräunlich bestäubt; die des ♀ ist mehr trübgrün, mit diffuser brauner Bestäubung

aller Ränder, die aber immer viel schmäler als bei *P. hexamitobalia* Tams bleibt. Vorderflugellänge 12 mm.

♂, ♀-type von Uganda, Nyakasura, 10. iii. 1937 (*J. F. Shillito*) im British Museum, London.

BIBLIOGRAPHICAL NOTICE.

A Guide to Veterinary Parasitology for Veterinary Students and Practitioners. By T. Southwell, D.Sc., Ph.D., and A. Kirshner, M.B., Ch.B., D.T.M. London: H. K. Lewis & Co., 1937. Pp. x + 144, 88 text-figures, 1 plate, and 12 diagrams. Royal 8vo. Price 7*s*. 6*d*.

This forms a companion volume to Blacklock and Southwell's 'Guide to Human Parasitology,' a notice of which appeared in this Journal in January 1932. It is similar in style to the former book, but, in spite of the much wider field to be covered, is of little more than half the size. The more important protozoan and helminth parasites of domestic animals are very briefly dealt with. The authors state in the introduction that the book represents, in condensed form, the lectures given to veterinary students in the University of Liverpool, where experience shows that in the time allowed it is only possible to deal with essentials. The information given certainly does not go beyond that limit, and one result of this extreme condensation is that many statements in the book are true only if applied strictly to the parasites of domestic stock, and are, in a wider zoological view, quite unsound. The text is by no means free from errors, and these are not all merely typographical. The illustrations, most of which are original, are good, and the plate of eggs of various parasites, all drawn to the same scale, should be particularly useful in diagnosis. There are very brief sections dealing with prophylaxis and diagnostic technique, and diagrams of selected life-histories which should be useful to the student.

H. A. B.

The Publishers regret that, owing to a printing error, the head-lines to the article by Dr. W. T. Calman on "The Type-specimens of *Pallene australiensis* Hoek (Pycnogonida)" in the November issue, pp. 530 and 532, were printed as by Mr. T. W. Calman.

THE ANNALS AND MAGAZINE OF NATURAL HISTORY.

[ELEVENTH SERIES.]

No. 2. FEBRUARY 1938.

XVIII.—*Eocene Mollusca from North-Western India.* By L. R. Cox, M.A., Sc.D., F.G.S. (Department of Geology, British Museum (Natural History)).

[Plates VI.–VIII.]

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I. INTRODUCTION.

This paper is intended primarily to describe a small series of Eocene mollusca collected in 1936 by Lt.-Col. L. M. Davies, M.A., in the Kohat district of north-western India. It may be regarded as supplementary to two previous papers by myself (Cox, 1930 and 1931) dealing with fossils collected by the same worker on previous visits to this area. It has proved desirable, however, to deal also with a few fossils from other sources; in particular, from two very fine collections formed a year or two previously by Mr. E. S. Pinfold in the Dera Ghazi

Khan and Dera Ismail Khan districts, farther south. An adequate description of all Mr. Pinfold's material will require a paper of much wider scope than the present one, and must, therefore, be deferred.

All the specimens described have been generously presented by their collectors to the British Museum (Natural History). I must also express my appreciation of the kindness of Professor A. Morley Davies and Dr. W. F. Whittard in arranging for the transference of the holotype of *Parinomya blanfordiana* from the collection of the Royal School of Mines to this Museum.

II. ON TWO SPECIES OF *ANOMIIDÆ* FROM THE EOCENE OF N.W. INDIA.

Certain representatives of the Anomiidæ are of considerable interest on account of the changes which take place during the growth of the shell. A well-known example is that of the genus *Carolia*, long ago described by Cantraine (1838) from the Eocene of Egypt. It will be of interest to refer to the development of the shell in this genus, as described by P. Fischer (1880, and 1886, p. 932), before discussing the generic affinities of the two Indian species dealt with in the present paper.

In its full-grown condition the genotype of *Carolia* (*C. placunoides* Cantraine) is a large, flattened, orbicular shell without a byssal foramen; it is ornamented with fine, sinuous, radial threads. Internally it is characterized in the right valve by a massive triangular resiliifer which is fused to the wall of the valve; this structure fits into a pit of corresponding shape, bordered laterally by two ridges, in the left valve. The following stages in the development of the right valve, each more or less comparable to the adult state of some other genus of the Anomiidæ, are recognized by Fischer :—

Anomia-like stage *.—The hinge-margin of the right valve is interrupted by a sinus for the protrusion of a byssus (presumably calcified, as in *Anomia*); the ligament is borne by a marginal process on the posterior side of the sinus. "*Ænigma*"-like † stage.—The byssal opening has become reduced to a foramen well separated from the margin, with which it communicates only by a fissure ; the process carrying the ligament has retreated from the margin, and has become elongated so as to stretch across the dorsal side of the foramen. *Placunanomia*-like stage.—The foramen has gradually closed, while the ligamental process, or resiliifer, which has become massive and broadly triangular in shape, has fused with the surface of the shell. Final, or "*Placuna*"-like *, stage.—All trace of the foramen has become obliterated.

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* Fischer (1880, p. 350) states that he has not actually observed this stage, but is undoubtedly justified in assuming its existence.

† The modern name for the molluscan genus formerly known as *Ænigma* Koch (pre-occupied in Coleoptera) is *Enigmonia* Iredale,

One of the two Indian species described below (*Parinomya blanfordiana*) closely resembles the genotype of *Carolia* in the fine radial ornamentation of its surface. Even in the full-grown shell, however, which remains much smaller than that of *Carolia*, both species retain a definite foramen joined to the margin by a linear fissure. The interior of *P. blanfordiana* is unknown, but the other species, *P. pinfoldi*, has a large, massive, triangular resiliifer which is depressed on to the surface of the shell, but is not fused with it. In one specimen this resiliifer lies right across the foramen, so that it is obvious that the byssus has atrophied ; in the other specimens the foramen is occupied by a calcareous plug.

These species correspond, therefore, to a developmental stage rather more advanced that the "*Ænigma*"-like stage of *Carolia*, but not so advanced as its *Placunanomia*-like stage. This developmental stage is precisely the same as that of a species from the Eocene of Peru described by A. A. Olsson (1928, p. 20, pl. iii. figs. 1–4) under the name *Carolia* (*Parinomya*) *parinensis*. Olsson's new subgenus *Parinomya* might as well have been placed under *Anomia* as under *Carolia*, since it represents a half-way stage between these two genera ; I now, however, advance it to generic rank.

Although the possibility must be recognized that *Parinomya* and the two Indian species may constitute a case of parallel evolution from *Anomia*, systematic palæontology must be based on observable facts rather than on hypothesis, and there is no demonstrable reason for placing the Indian species in a distinct genus. The surface-ornamentation of *P. pinfoldi* consists, moreover, of prominent radial riblets, just as in the Peruvian genotype.

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* The prior generic name *Placenta* Retzius now replaces *Placuna* Bruguière.

Genus PARINOMYA Olsson, 1928.

Olsson's original diagnosis is as follows :—

"Shell in form and general features like *Carolia* s. s., but the exterior marked with a submicroscopic rasp-like or pectinate sculpture, the finer growth lines being drawn out at intervals into teeth-like extensions, radially arranged ; resilium internal ; interior of right valve with a large chondrophore which, as in *Carolia* s. s., is situated on the anal or posterior side of the umbo and extends adorally above the byssal foramen, but remaining free or separate from the dorsal margin by an open slit or cleft ; byssal foramen large, open, or closed only by a byssal plug."

If the two species now described are included in *Parinomya*, its diagnosis may be emended to the following :

Radially sculptured Anomiidæ with a byssal foramen well removed from the dorsal margin, with which it communicates only by a linear fissure ; in the full-grown shell the foramen remains open, or is closed only by a calcareous plug. Resilium internal ; resiliifer triangular, massive, and depressed, but not fused with the wall of the shell ; it extends above or across the byssal foramen.

Parinomya pinfoldi, sp. n.

(Pl. VI. figs. 1 *a*, *b*, *c*, 2 and Pl. VII. fig. 1.)

Specific Characters.—Shell attaining a diameter of about 60 mm., ovate or orbicular, usually with a pronounced undulation of its ventral margin, which gives it a saddle-like shape. Left valve feebly to moderately convex, with an inconspicuous, depressed, obtuse umbo situated close to the dorsal margin ; right valve flat or slightly concave. Ornamentation consisting of conspicuous, sinuous, occasionally bifurcating, and at times discontinuous radial ribs ; these may form short spines where they cross the edges of the layers of growth, which imbricate at intervals. The number and the closeness of the spacing of the ribs vary considerably in different specimens ; on the umbonal region of the left valve the ribs are usually very short and discontinuous, giving rise to a rasp-like surface ornamentation. Foramen ovate, ranging from 2 mm. to 8 mm. in length, and situated 2–4 mm. from the dorsal margin, to which it is joined by a linear fissure; it is occupied by a calcareous plug, which projects slightly above the general surface level. Resiliifer massive, triangular, its apex almost touching the dorsal margin.

Remarks.—This species much resembles *P. parinensis* Olsson, type-species of *Parinomya*, both in the disposition and shape of its foramen and resiliifer and in the strength of its radial ornamentation. In *P. parinensis*, however, the ribs are drawn out at fairly regular intervals into sharp, tooth-like extensions; this feature is not observable in the species now described.

Occurrences and Material.—Lutetian, Lower Khirthar, shales between Habib Rahi and Pir Koh Limestones:—Mile 56, Moghul Koh Road, Dera Ismail Khan (the holotype, L.70371, Pl. VI. figs. 1 *a–c*, and two paratypes, L.70372, Pl. VII. fig. 1, and L.70373); Mittha Sor. Dera Ghazi Khan (one specimen, L.70374, Pl. VI. fig. 2), Khalgari Nullah, Dera Ghazi Khan (three specimens, L.70375–7); Khaura Sai, N. of Khosa, Dera Ghazi Khan (one specimen, L.70378). All from Mr. E. S. Pinfold's collection.

Parinomya blanfordiana, sp. n. (Pl. VI. figs. 3 *a*, *b*, *c*.)

Specific Characters.—Shell attaining a diameter of about 55 mm., orbicular, with no pronounced marginal undulations. Left valve moderately convex, with an inconspicuous, depressed, obtusely angular umbo which is usually close to the dorsal margin; right valve flat or concave. Ornamentation consisting of fine, flexuous, rather discontinuous radial threads which are usually separated by slightly wider interspaces; the growth-layers may imbricate at rather distant intervals. Foramen ovate, 5–6 mm. in length, and situated about 4 mm. from the margin, to which it is joined by a linear fissure. Internal characters unknown.

Remarks.—This species is considered to be congeneric with *P. pinfoldi*, described above, as its foramen is of similar size and position. Its surface ornamentation agrees very closely with that of the Egyptian Eocene species *Carolia placunoides* Cantraine, already discussed, and it may possibly be its ancestor *. At the stage in its growth at which its diameter is roughly the same as that of the full-grown shell of the species now described, *C. placunoides* still possesses an open foramen, joined by a linear fissure to the margin, but the umbo of its left valve is more prominent than in this species; when full-grown it is very much larger than the Indian form.

I am informed that in the collections of the Geological Survey of India this species has long borne the unpublished name "*Anomia blanfordiana* Noetling." The same trivial name is, therefore, here retained. A specimen formerly in the collection of the Royal School of Mines has been taken as holotype.

Occurrences and Material.—Lutetian, Lower Khirthar:—Dharan Pass, Laki, Sind (the holotype, L.70370, Pl. VI. figs. 3 *a*, *b*, *c*).

Lutetian, Lower Khirthar, low in Kohat Shale:—Kohat, North-West Frontier Province (two specimens, L.70421–2, Col. L. M. Davies Coll.).

Ypresian, Upper Laki, Ghazij Shale:—S. of Nila Kund, Dera Ghazi Khan (seven specimens, L. 70379–85, Pinfold Coll.).

III. FOUR SPECIES OF LAMELLIBRANCHIA FROM THE EOCENE OF THE KOHAT DISTRICT.

Four species collected by Lt.-Col. L. M. Davies, M.A., in the Eocene of the Kohat district of the North-West Frontier Province are here described. The *Cuspidaria* has also been found by Mr. E. S. Pinfold in the Dera Ghazi Khan district, and one of his specimens is figured as holotype of the species.

Genus OSTREA Linné, 1758.

Ostrea prælatimarginata, sp. n. (Pl. VII. figs. 4 *a*, *b*.)

Specific Characters.—Shell of medium size, suborbicular, with a feebly convex lower valve and a slightly concave upper valve; in the holotype the attachment area of the lower valve is equal to about one-eighth of its total area.

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* Oppenheim (1903, p. 48) states that *C. placunoides* occurs rarely in the Lower Mokattam Stage of the Egyptian Eocene, and commonly in the Upper Mokattam Stage. Its earliest occurrence in Egypt is, therefore, slightly later than the earliest occurrence of *P. blanfordiana* in India.

On its inner side the margin of the lower valve is bordered by a very wide flattened area external to the visceral cavity, which alone is covered by the upper valve. The lower valve is ornamented with depressed, rounded, occasionally divaricating radial riblets which give rise to a delicate crenulation of its margins. The upper valve bears a series of rather wide-spaced, narrow, concentric ridges.

Dimensions.—The measurements of the holotype are as follows:—Length 28·0 mm., height (slightly incomplete) 28·5 mm., inflation 5·5 mm.

Remarks.—The exterior of the lower (left) valve of the holotype is somewhat eroded, but the character of the ornamentation is clearly enough visible. The flattened marginal region of the lower valve was originally even wider than as at present preserved, as the margin is somewhat broken away.

This species is of interest on account of its very close resemblance to *Ostrea latimarginata* Vredenburg *, from the Lower Miocene of N.W. India, Iran, Arabia, East Africa and Burma. In the species in question, however, the ribs are somewhat narrower and more prominent. *O. plicata* (Solander) [=*O. flabellula* Lamarck], from the Eocene of England, France, and elsewhere, differs in that its marginal area, if present, is always narrower and more oblique to the plane of the valve margins than in the species now described. A wide, flattened marginal area comparable to that of the species now described, in fact, is not developed in any previously known Eocene species.

Occurrence and Material.—Landenian, Upper Ranikot:—12 miles S. of Thal, North-West Frontier Province (the holotype only, L.70389).

Ostrea aff. *multicostata* Deshayes. (Pl. VII. figs. 2 *a*, *b*.)

Compare, especially, the following figured forms, which have been regarded as varieties of *O. multicostata*:—

Ostrea elegans Deshayes vars. *exogyroides* and *cornigera* Oppenheim, 1903, p. 19, pl. i. figs. 6, 7, and pl. xvii. figs. 2, 6.

Ostrea moussoulensis var. *raulini* Astre, 1922, p. 175, pl. ii. figs. 1–3.

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* See L. R. Cox, 1936, p. 46, for references to this species.

Ostrea multicostata var. *strictiplicata* Raulin and Delbos, Yang Kieh, 1930, p. 81, figs. *b–f* especially and pl. vi. figs. 12 *a–c*.

Description.—A moderately large, thick-shelled lower valve characterized by a pronounced curve of the umbonal region in a posterior direction, giving it a lunate shape; except for its umbonal region it is approximately parallel-sided. The angle between the median axis of the ligamental area, which is moderately elongate but not greatly curved, and that of the part of the shell most remote from the umbo corresponds to a rotation of rather more than 90° during growth. The ligamental area is not at all undercut. The surface of the shell bears fairly strong, rounded, occasionally divaricating radial ribs which are crossed, at somewhat irregular intervals, by imbricating layers of growth, which produce a rather frilly type of ornamentation.

Dimensions.—The shell measures 79 by 41 mm.; its maximum inflation is 29 mm.

Remarks.—This specimen belongs to a species of *Ostrea* which is widely distributed in the Eocene deposits of the Tethyan province and has been discussed at some length by Astre (1922) and Yang Kieh (1930). The species in question has been considered by many authors to be identical with *O. multicostata* Deshayes, originally described from the Cuisian of the Paris Basin, but was separated by Raulin and Delbos (1855, p. 1152) as a distinct species, *O. strictiplicata.* Astre agrees with its specific separation, but proposes for it another new name, *O. moussoulensis*, since, in their description of *O. strictiplicata*, Raulin and Delbos (1855, p. 1158) cited a figure published by Deshayes (1832, pl. l. fig. 6) of a Paris Basin specimen clearly referable to another species, *O. bellovacina* Lamarck. Yang Kieh, on the other hand, accepts the name *O. strictiplicata*, but regards this form as a variety of *O. multicostata*, and, in a sweeping synonymy, includes in this species certain exogyrate forms from the Eocene of northern Africa and gryphæate forms from the Eocene of Central Asia.

Astre's numerous illustrations of specimens from the Montagne-Noire, in France, indicate the great variability of *O. "moussoulensis."* He considers this species to be distinguished from *O. multicostata* by its wider, less often dichotomizing, and usually less numerous costæ, and by the fact that its ligamental area is not at all undercut. As regards costation, however, the differences between some of the specimens of *O.* "*moussoulensis*" which he figures (for example, pl. i. fig. 11, pl. ii. fig. 6, pl. iv. fig. 3, pl. v. fig. 5, and pl. vi.) and typical specimens of *O. multicostata* appear insignificant. I doubt, in fact, if the distinction between the two forms, which are stated to occur at the same horizon in northern Africa, is admissible.

In a recent paper (1936, p. 30) I have preferred not to interpret *O. multicostata* in the wide sense of Yang Kieh, and have referred certain gryphæate oysters from the Eocene of Bahrein Island, which he, presumably, would include in that species, to *O. turkestanensis* Romanovski. The study of a number of specimens from Afghanistan, however, has since led me to conclude that Yang Kieh may, after all, be correct, and that this form may merely be a race of *O. multicostata*. The gryphæate oysters of this group are particularly characteristic of the Eocene of Asia, although they have not yet been found in India.

Exogyrate oysters of this group, on the other hand, are especially characteristic of the Eocene of northern Africa, and particularly Egypt, so that it is of interest to meet with the semi-exogyrate form now described in India. In view of the wide range of variation illustrated in Astre's figures it seems doubtful if this shell, although so different from specimens from the type-locality of the species, should be separated from *O. multicostata*. It closely resembles Astre's var. *raulini*.

Occurrence and Material.—Ypresian, Upper Laki, uppermost Shekhan Limestone :—6 miles E. of Kohat, North-West Frontier Province (one specimen, L.70407).

Genus CARDITA Bruguière, 1792.

Subgenus VENERICARDIA Lamarck, 1801.

Cardita (*Venericardia*) *daviesi*, sp. n.

(Pl. VII. figs. 5 *a*, *b*, 6 *a*, *b*.)

Specific Characters.—Shell of medium size (length about 23 mm.), strongly gibbose, subquadrate, with its length only slightly exceeding its height. Umbones strongly prosogyrous, anteriorly placed ; profile of umbonal region not at all prominent. Postero-dorsal margin nearly straight, subhorizontal, meeting the nearly straight posterior margin in a rather wide curve; in a ventral direction the posterior margin slopes towards the anterior end of the shell. Ventral margin flattened or feebly convex, sloping up slightly in an anterior direction. Anterior end of shell short and low; lunule well excavated. Ornamentation consisting of about 25 radial ribs, excluding any which may have been present on the lunule (obscured in the available specimens); the ribs, which are separated by slightly narrower interspaces, are evenly rounded and undivided, and bear small bead-like tubercles.

Dimensions.—The exact measurements of the holotype (the larger of the two specimens examined) are:—Length 23·2 mm., height 22·0 mm., inflation 21·0 mm.

Remarks.—At first sight this shell recalls the well-known Upper Cretaceous species, *Cardita* (*Venericardia*) *beaumonti* d'Archiac & Haime (1854, p. 253, pl. xxi. figs. 14, 14 *a*, *b*). It is, however, more quadrate, while its ribs, which number 25 or more, as compared with 18–22 in *C. beaumonti*, are narrower and more conspicuously beaded than in that species, and have no tendency to become tripartite. This difference in the character of the ribbing suggests that the species now described may not even belong to the same group as *C. beaumonti* *. It is, probably, more closely related to *C.* (*V.*) *imbricata* (Gmelin), of the European Eocene, which is similarly characterized by simple beaded ribs. Its strong inflation serves to distinguish the species now described from *C. imbricata* and other species of its group.

Occurrence and Material.—Lower Eocene, Montian ?, Haugu Shale:—1 mile W. of Darsamund, near Hangu (the holotype, L.70417, Pl. VII. figs. 6 *a*, *b*, and one paratype, L.70418, Pl. VII. figs. 5 *a*, *b*).

Genus Cuspidaria Nardo, 1840.

Cuspidaria lakiensis, sp. n. (Pl. VII. figs. 3 *a*, *b*.)

Specific Characters.—Shell attaining a length of 40 mm. or more, well inflated, very slightly inequivalve, with the left valve the more gibbose. Posterior rostrum of moderate length, dorsally situated, curving slightly to the right. Umbones just anterior to medium, slightly opisthogyrous and recurved; umbonal profile rather narrowly rounded, rising slightly above the antero-dorsal margin and more prominently above the postero-dorsal margin. Postero-dorsal margin straight, subhorizontal. Antero-dorsal margin slightly convex, sloping at a moderately steep angle, and meeting the anterior margin in an even curve. Anterior margin at times somewhat flattened along its ventral half, which slopes in a posterior direction until it merges with the ventral margin in an obtuse curve. Ventral margin strongly but asymmetrically convex, ascending steeply posteriorly towards the beginning of the rostrum, below which it is pronouncedly sinuate. The end of the rostrum is broken away in all the available specimens, but appears, from the growth-lines, to have been truncated subvertically. An obtuse ridge curves round from the umbo to the ventral corner of the rostrum; there is no impressed escutcheon.

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* *C. beaumonti* and related species are discussed in a recent paper by R. Rutsch (1936).

The shell, which is thin, is ornamented with strong but rather narrow concentric undulations, which fade away on the rostrum; this surface ornamentation is clearly impressed on the internal cast. Impressions of hinge-teeth, pallial line, and muscle scars are not preserved.

Dimensions.—The measurements of the holotype (Pl. VII. figs. 3 *a*, *b*), the largest available specimen, are:—Length 37·5 mm.*, height 27·0 mm., inflation 19·0 mm.

Remarks.—This shell bears some superficial resemblance both to the Recent genus *Raeta* Gray and to the Eocene genus *Raetomya* R. B. Newton (1919; see also Seitz and Rutsch, 1930), but is distinguished by its narrow posterior rostrum. Its general shape suggests that it may be related to *Cuspidaria*, but it is considerably larger than Recent representatives of that genus. *Cuspidaria* is, moreover, a genus of deep-water habitat at the present day; hence the occurrence of the species now described in apparently shallow-water deposits suggests that it may prove to belong to a distinct group. No related species appears to have been described from the Eocene of other regions.

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* About 10 mm. should be added to this measurement, as the rostrum of the specimen is broken.

Occurrences and Material.—Ypresian, Upper Laki, Ghazij Shale :—S. of Nila Kund, Dera Ghazi Khan (the holotype, L.70386, Pl. VII. figs. 3 *a*, *b*, and two paratypes, L. 70387–8, Pinfold Coll.).

Ypresian, Laki, 174 ft. below gypsum :—Panoba Nullah, near Kohat (one specimen, L.70403, Col. L. M. Davies Coll.).

IV. MOLLUSCA FROM THE LOWER CHHARAT BEDS OF THE KOHAT DISTRICT.

In the North-West Punjab and the Kohat district of the North-West Frontier Province the succession of marine Eocene strata is interrupted by the Lower Chharat Beds [*], which lie between the uppermost marine Laki limestone (the Shekhan Limestone of Lt.-Col. L. M. Davies) and the Kohat Shale at the base of the Khirthar. The horizon of these beds, which in the type-area consist of a considerable thickness of variegated shales with *Planorbis* and bone fragments, is, therefore, approximately the same as that of the upper part of the Ghazij Shales in the region to the south.

The fossils now described, which were collected by Mr. E. S. Pinfold and Lt.-Col. L. M. Davies, are of interest as coming from the only locality [†] in which marine or estuarine fossils have been found in these otherwise purely non-marine beds. They consist of numerous small shells, some rather eroded, preserved on the surface of thin slabs of limestone. Three species, *Trypanaxis ? daviesi*, sp. n., *Siphonalia* sp., and *Corbula pinfoldi*, sp. n., are here described; a small *Natica* and at least two other gastropod species are also present, but cannot be described from the material at present available. No previously described species has been recognized, so that the fossils throw no further light on the exact age of the beds.

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[*] See E. S. Pinfold, 1918, and L. M. Davies, 1926.

[†] The section, which is in the hills about 2 miles W.S.W. of Barbara Banda village, and whose coordinates are approximately 33° 16′ N., 71° 6′-E., is illustrated by A. B. Wynne (1875, pl. v. fig. 23). Wynne (1875, pp. 115–16) talks of finding "nummulites and other fossils" in the "red clay zone" (his term for the Lower Chharat Beds) at this locality. Mr. Pinfold and Lt.-Col. Davies have found, however, that the limestone flags with nummulites referred to by Wynne have slipped down fron an overlying formation. Thin bands containing the mollusca now described are undoubtedly *in situ*.

Class GASTROPODA.

Genus TRYPANAXIS Cossmann, 1889.

Trypanaxis ? daviesi, sp. n. (Pl. VIII. figs. 1, 3, 4, 5.)

Specific Characters.—Shell attaining a height of about 30 mm., extremely acute, consisting of a large number of narrow whorls which are separated by deeply incised sutures; the whorls are strongly convex near the apex, but later become rather flattened. A rapid increase in diameter, but not in height, takes place on the last whorl, the base of which is short and flattened. The columella was probably perforate. The aperture appears to have been suborbicular in shape, with a short anterior canal, but its outline is visible only very obscurely in the single specimen in which it is preserved The ornamentation consists of two or three spiral threads on the early whorls, increasing to four on the later ones; one of these threads adjoins the anterior suture, while the others are distributed rather irregularly over the remainder of the surface.

Remarks.--This species, which is remarkable for its large number of whorls and very acute shape, is very abundant in the slabs of limestones whose fauna is now described, but there are no complete uneroded specimens. In most of the specimens the interior of the shell has been filled with calcite which is not now clearly distinguishable from the original shell-wall. In some of the specimens the actual shell seems to have disappeared owing to solution or erosion, but it is evident that it still remains in others, as traces of the surface ornamentation are visible. The umbilicus and deep sutures which are present in all the specimens appear, therefore, to be features of the original shell and not cavities formed by solution of the columella and shell-wall. It is, moreover, improbable that in so small a shell the columella alone would have been thick enough to occupy the whole space represented by the present umbilicus, whose diameter on the last whorl well exceeds 1 mm.

This conclusion is important, as it suggests that the species may belong to the genus *Trypanaxis*, the only perforate representative of the Cerithiidæ and Cerithiopsidæ, to one of which families it is obviously referable. In *Trypanaxis*, moreover, the ornamentation usually consists of spiral threads to the exclusion of granulations or axial costæ, just as in the species now described. The enlargement of the last whorl and the deep sutures, however, are not characters associated with any previously known representatives of the genus.

Occurrence and Material.—Upper Ypresian or Lower Lutetian, Lower Chharat Beds :—Barbara Banda, 33 miles S.S.W. of Kohat, North-West Frontier Province (numerous specimens, including the holotype, G.63556, Pl. VIII. fig. 4, preserved on four small slabs of limestone).

Genus Siphonalia A. Adams, 1863.

Siphonalia ? sp. indet. (Pl. VIII. figs. 1, 2.)

Description.—Shell pyriform, with a conical spire occupying about two-fifths of the total height, which is about 14 mm. The whorls are strongly convex, a distinct shoulder developing on the last, which is well excavated above its short, straight, and apparently narrow canal. The ornamentation consists of rounded axial ribs with a slight retrocurrent inclination ; on the spire whorls these are narrow and are separated by interspaces of about twice their own width ; on the last whorl they become relatively wider, and project at their anterior extremity, which coincides with the shoulder-angle ; they die out just below the periphery. The aperture is not preserved in any of the specimens.

Remarks.—This species is represented only by two eroded casts and by one specimen of the last whorl on which a portion of the original shell remains, and so is not nameable. Its shape and the general character of its ornamentation suggest its reference to the genus *Siphonalia*, but its anterior canal, on the other hand, is straighter than is normal in that genus.

Occurrence and Material.—Upper Ypresian or Lower Lutetian, Lower Chharat Beds :—Barbara Banda, 33 miles S.S.W. of Kohat, North-West Frontier Province (three specimens, G.63557*b* and G. 63558).

Class LAMELLIBRANCHIA.

Genus Corbula Bruguière, 1797.

Corbula pinfoldi, sp. n. (Pl. VIII. figs. 6–8.)

Specific Characters.—Shell small (about 3 mm. in length), gibbose, subtrigonal, slightly inequivalve, with the right valve rather higher than the left; height and length approximately equal. Umbones strongly prosogyrous, placed from the anterior third to fifth of the length, prominent in the right valve, less prominent in the left. In each valve a well-defined, evenly curved carina runs from the umbo to the postero-ventral corner. The postero-dorsal margin is feebly convex and slopes gently to meet the straight or slightly concave posterior margin in a well-defined, slightly obtuse angle of about 110°. The ventral margin is evenly and moderately strongly convex, meeting the posterior margin in a well-defined angle, and joining the strongly convex anterior margin in an even curve. The region anterior to the umbones is well excavated. The surface of the shell is completely smooth in the available specimens, which, however, are slightly eroded.

Dimensions.—The exact measurements of the holotype and of two other specimens are as follows:—Holotype (right valve), length 3·5 mm., height 3·5 mm., inflation 1·5 mm.; paratype (right valve), length 3·0 mm., height 2·8 mm., inflation 1·1 mm.; paratype (left valve), length 3·2 mm., height 2·6 mm., inflation 0·7 mm.

Remarks.—In size and shape this species bears a considerable resemblance to *Corbula globosa* J. Sowerby (1818, p. 14, pl. ccix. fig. 3), from the London Clay. In that species, however, the umbones are rather less anterior, the posterior margin is more convex, and the posterior carina less well-defined.

Occurrence and Material.—Upper Ypresian or Lower Lutetian, Lower Chharat Beds:—Barbara Banda, 33 miles S.S.W. of Kohat, North-West Frontier Province (the holotype, L.70436 *a*, Pl. VIII. fig. 8, and numerous other specimens, preserved on the surface of three slabs of limestone).

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EXPLANATION OF THE PLATES.

(All figures are of natural size unless it is otherwise stated.)

Plate VI.

Figs. 1 *a*, *b*, *c*. *Parinomya pinfoldi*, sp. n. Holotype (L.70371), (*a*) left valve, (*b*) right valve, (*c*) ventral margin. Lutetian, Lower Khirthar. Mile 56, Moghul Koh road, Dera Ismail Khan. (Page 164.)

Fig. 2. The same. Paratype (L.70374), left valve. Same horizon as the preceding. Mittha Sor, Dera Ghazi Khan.

Figs. 3 *a*, *b*, *c*. *Parinomya blanfordiana*, sp. n. Holotype (L.70370), (*a*) left valve, (*b*) right valve, (*c*) ornamentation of right valve, ×3. Lutetian, Lower Khirthar. Dharan Pass, Laki, Sind. (Page 164.)

PLATE VII.

Fig. 1. *Parinomya pinfoldi*, sp. n. Right valve paratype (L.70372), view of interior, showing the resiliifer, which here lies across the foramen. Lutetian, Lower Khirthar. Mile 56, Moghul Koh road, Dera Ismail Khan. (Page 165.)

Figs. 2 *a*, *b*. *Ostrea* aff. *multicostata* Deshayes. Left valve (L.70407), (*a*) exterior, (*b*) interior. Ypresian, Upper Laki, uppermost Shekhan Limestone. 6 miles E. of Kohat. (Page 167.)

Figs. 3 *a*, *b*. *Cuspidaria lakiensis*, sp. n. Holotype (L.70386), (*a*) right valve, (*b*) dorsal view. Ypresian, Upper Laki, Ghazij Shale. S. of Nila Kund, Dera Ghazi Khan. (Page 170.)

Figs. 4 *a*, *b*. *Ostrea prælatimarginata*, sp. n. Holotype (L.70389), (*a*) left valve, (*b*) right valve. Landenian, Upper Ranikot. 12 miles S. of Thal. (Page 166.)

Figs. 5 *a*, *b*. *Cardita* (*Venericardia*) *daviesi*, sp. n. Paratype (L.70418), (*a*) left valve, (*b*) dorsal view. Montian ?, Hangu Shale. 1 mile W. of Darsamund, near Hangu. (Page 169.)

Figs. 6 *a*, *b*. The same. Holotype (L.70417), (*a*) left valve, (*b*) dorsal view. Same occurrence as the preceding.

PLATE VIII.

Fig. 1. *Trypanaxis* ? *daviesi*, sp. n. Large internal cast (G.63557 *a*) and several small specimens, and fragment of *Siphonalia* ? sp. indet. (G. 63557 *b*) near top right-hand corner, × 1¼. Upper Ypresian or Lower Lutetian, Lower Chharat Beds. Barbara Banda, 33 miles S.S.W. of Kohat. (Page 173.)

Fig. 2. *Siphonalia* ? sp. indet. (G.63558.) Same occurrence as the preceding. (Page 174.)

Fig. 3. *Trypanaxis* ? *daviesi*, sp. n. Specimen (G.63556 *b*) of apical whorls, on the back of the block containing the holotype, × 4½. Same occurrence as the preceding.

Fig. 4. The same. Holotype (largest specimen, G.63556 *a*) and other specimens, × 1¼.

Fig. 5. The same. Small specimens (G.63557 *c*) seen in top right-hand corner of fig. 1, × 4½.

Fig. 6. *Corbula pinfoldi*, sp. n. Right and left valve paratypes (L.70436 *b*, *c*), × 3. Same occurrence as preceding specimens (Page 174.)

Fig. 7. The same. Right and left valve paratypes (L.70436 *d*, *e*), preserved on the same slab as the specimens represented in fig. 6, × 3.

Fig. 8. The same. Holotype, a right valve (L.70436 *a*), preserved on the same slab as the specimens represented in figs. 6, 7, × 4.

XIX.—*Un Eucnemide* (*Col.*) *nouveau de Borneo.*

Par E. FLEUTIAUX.

Curticephalus bryanti, sp. n.

6 mm. Etroit, parallèle ; noir avec une grande tache jaune à la base des élytres, arrêtée au premier et au dernier interstrie, et une autre, également jaune, sur la

suture, occupant les deux premiers interstries, depuis la moitié environ jusque près de l'extrémité ; pubescence peu apparente. Tête convexe, légèrement impressionnée en avant, finement carénée au milieu jusque sur l'épistome ; ponctuation forte et serrée ; crêtes sousantennaires non prolongées vers le milieu ; épistome très rétréci à la base. Antennes noires, extrémité du 1er article et le 2e jaunes ; 2e très petit ; 3e plus long que le suivant ; 4e 5e égaux (suivants manquent). Pronotum plus long que large, arrondi en avant, limité latéralement, convexe, faiblement sillonné au milieu en arrière ; ponctuation forte et très serrée. Elytres de même largeur que le pronotum, parallèles dans leur première moitié, rétrécis au delà, conjointement arrondis au sommet, moins fortement et moins densément ponctués que le pronotum à la base, finement vers le bout ; légèrement striés. Dessous noir, assez fortement ponctué. Propleures déprimés le long du bord externe, sutures prosternales courbés. Episternes métathoraciques parallèles, à peu près aussi larges que les épipleures des élytres à la moitié de leur longueur. Hanches postérieures élargies en dedans, à bord inférieur sinueux. Dernier arceau ventral tronqué. Pattes jaune pâle.

Borneo : Quop, ouest Sarawak, avril (*G. E. Bryant*).

Un seul individu, British Museum, London.

Plus petit que *C. angustus* Fleutiaux. Diffère par le pronotum noir, les élytres ornés d'une bande suturale partielle jaune, le dessous entièrement noir.

XX.—*New* Curculionidæ (*Col.*) *from Southern Africa*.

By Sir Guy A. K. Marshall.

Except where otherwise stated the types of these species are in the British Museum.

Subfamily *Otiorrhynchinæ*.

Sphrigodes decorus, sp. n.

♂. Derm red-brown, with dense brown scaling and pale green markings ; prothorax with a narrow green median stripe (often interrupted in the middle) and a broad green lateral stripe, and a green area on the pleuræ just above the coxæ; elytra brown, with the following green markings: a stripe starting at the base on intervals 7–9, narrowing at one-fourth so as to cover only 8 and 9, and at the middle bending inwards in the form of a broad irregular oblique stripe as far as stria 1 at the top of the declivity, a broad subapical lateral patch between stria 7 and the lateral margin (sometimes divided by a brown stripe on interval 9), a small quadrate spot at base of interval 4 and a more elongate one at a short distance behind it, and sometimes a small spot not far from the base on interval 6 adjoining the lateral stripe; underside with fairly dense pale greenish scaling.

Head with greyish-brown scaling, turning to green laterally, the forehead flat and with a deep median stria, the eyes not very convex. *Rostrum* a little longer than its width at the genæ, parallel-sided in the basal half, roundly dilated apically; the dorsal area flat, widest not far from the base, narrowing rapidly to the base and more gradually in front, subcarinate laterally, and with a low median carina which usually bifurcates in front; the epistome well defined, with its margins obtusely carinate, the interantennal space about as wide as the forehead. *Antennæ* red-brown, with the scape rather abruptly clavate; the funicle with joint 2 very slightly longer than 1, the distal joints distinctly longer than broad. *Prothorax* transverse, widest at the base, gradually narrowing to two-thirds, with the sides straight and the basal angles almost rectangular, then roundly narrowing to the apex, which is very shallowly constricted, with the constriction continued across the dorsum, the base gently arcuate; the dorsum longitudinally convex, with dense subreticulate punctures, each of which is covered by a round flat scale, leaving only the narrow intervals visible. *Elytra* broadly ovate, widest before the middle, acuminate behind, with the basal margin jointly sinuate and not carinate or constricted laterally; the punctures in the shallow striæ separated and partly concealed by scaling; the intervals broad and flat, with contiguous convex scales, the very short spatulate recumbent setæ irregular and inconspicuous. *Legs* red-brown, with uneven pale scales; the hind tibiæ with the dorsal edge sinuate, the lower edge with three teeth, but without any apical sinuation.

♀. The markings green or grey, the elytra with the oblique bands meeting at the suture, the spots towards the base on interval 4 uniting to form a short stripe, and an additional green spot on interval 4 at one-third from the base. The elytra somewhat broader than in ♂, more acuminate behind, and with the apices produced downwards.

Length 3·8–4·0 mm., breadth 2·0–2·2 mm.

TRANSVAAL: Politsi, 4 ♂♂, 2 ♀♀, ii. 1929.

Very similar to *S. ornatus* Fhs. (Ann. & Mag. Nat. Hist. (8) xix. 1917, p. 2, fig.—*S. gunni* Mshl.), but smaller and with different markings; further, in *ornatus* the eyes are much more convex, the rostrum has no median carina, and the epistome is not clearly defined.

Sphrigodes lateralis, sp. n.

♂♀. Derm red-brown, with fairly dense brown or greyish-brown scaling, which does not, however, entirely conceal the integument; prothorax with two very indefinite and irregular lateral pale stripes (sometimes absent) formed of scattered grey scales; elytra with a complete lateral whitish stripe on interval 8, extending on to 9 in the basal half and sometimes on to 7 for a short distance behind the middle, and sometimes a small whitish spot at the base of interval 4; in the ♀ the pale lateral stripe on the elytra is less distinct or even absent; underside with uniform separated grey scales.

Head densely squamose, the forehead much broader than the interantennal space, flat, with a deep short median furrow; eyes moderately convex. *Rostrum* a little longer than its width across the genæ, narrowing very slightly from the base to the antennæ and roundly dilated at the genæ; the dorsal area broad, almost parallel-sided, flat, subcarinate laterally, and with an indistinct low median carina ending in an elongate fovea just behind the epistome, which has its margins obtusely elevated. *Antennæ* short and stout, the scape only shortly exceeding the front margin of the prothorax and gradually clavate; funicle with the two basal joints subequal, the distal ones a little longer than broad, clavate. *Prothorax* transverse, rounded laterally, widest close to the base which is strongly arcuate with the angles rounded, not constricted at the apex; the dorsum almost flat longitudinally in the middle, the sculpture and scaling as in *S. decorus*. *Elytra* very broadly ovate, widest before the middle, obtusely acuminate behind, with the actual apex more pointed in ♀ and slightly produced downwards, the base jointly sinuate, not carinate, nor constricted laterally; the shallow striæ with the punctures separated and partly concealed by scaling; the intervals broad and flat, but interval 1 much narrowed towards the base; the scales contiguous and convex, the small spatulate setæ irregular and inconspicuous. *Legs* red-brown, with fairly dense grey scaling; the hind tibiæ straight dorsally, irregularly denticulate on the inner edge.

Length 3·7-4·5 mm., breadth 2·3-3·0 mm.

TRANSVAAL: Barberton, 3 ♂♂, 2 ♀♀, i. 1928 (*J. S. Taylor*).

Distinguished from the other South African species by its gradually clavate scape, broad forehead, straight hind tibiæ, and by having the elytra much more obtuse posteriorly.

Subfamily LEPTOPINÆ.

Enicoderus viridicollis, sp. n.

♂♀. Derm black, the head and rostrum with sparse creamy or pale green scales, the apex of the rostrum green; the prothorax with dense metallic green scaling on the disk and a transverse row of four distant whitish spots across the base, the pleuræ with a broad irregular pale stripe suffused with orange in the middle; the elytra with fuscous scaling, a pale brassy (sometimes greenish) sutural stripe that widens to stria 3 at the base, and a broad dense pale lateral stripe from stria 7 to the margin having either a brassy reflection or a suffusion of orange; the underside with more or less dense creamy scales.

Head with scattered low shiny granules showing through the scaling; the broad forehead flattened in ♂ and slightly convex in ♀, with short subrecumbent setæ. *Rostrum* of ♂ much flattened and explanate dorsally, a little longer than broad, strongly rounded laterally, rapidly widening from the base to near the antennæ, thence narrowing as rapidly to the apex; the apical area rather steeply declivous and flat transversely; the dorsal area with a broad shallow longitudinal impression on each side, the lateral margins carinate in the basal half; rostrum of ♀ of normal form, parallel-sided in the middle and moderately widened at base and apex, the apical area with a low obtuse elevation in the middle, the dorsal area with a strong squamose median carina and two low oblique carinæ on each side of it, the lateral margins rounded off *Antennæ* with joint 1 of the funicle as long as 2 + 3, 2 much longer than 3, 3-7 subequal and about as long as broad. *Prothorax* of ♂ a little broader than long, 0·5 mm. wider than the widest part of the elytra, constricted at base and apex, with the postocular lobes strong and vibrissate, truncate at the base; the dorsum convex longitudinally, highest at one-third from the base, set with numerous small low shiny granules and short pale recumbent setæ, and with a very indistinct median stria in the basal half; prothorax of ♀ somewhat more transverse and much less strongly rounded laterally, narrower than the widest part of the elytra. *Scutellum* small, transverse, with narrow scales. *Elytra* similar in the two sexes, elongate and very narrow, truncate at the base, from there narrowed for a short distance, then gently rounded to the apex, where there are two small projections which are a little longer and more slender in ♀; the striæ somewhat obscured near the base by the very large rugose punctures, but narrower and well defined in the apical half, where the punctures are much smaller, the striæ on the lateral areas almost entirely concealed by the dense scaling; the intervals narrow and ill-defined basally, but broad behind and with indefinite bare spots on the brown discal areas, from which the setæ arise; these latter very short, subrecumbent and inconspicuous throughout in ♂, similar on the basal half in ♀, but long and erect behind. *Legs* red, with the tarsi fuscous, the femora appearing paler than the tibiæ owing to being largely devoid of scaling, set with sparse erect setæ; the front tibiæ set with small sharp teeth, smaller ones on the middle pair and none on the hind, which latter also have no trace of a mucro, and the corbels are clothed with dense long flattened setæ; the front coxæ less widely separated than the median pair.

Length 10·7–12·0 mm., breadth 3·0–3·2 mm.

BRITISH BECHUANALAND : Upington, 1 ♂, 2 ♀♀ (*Lennox*).

Readily distinguished from the three previously described species of the genus by its much greater size and very striking coloration. Unfortunately one species, *E. anatirostris* Mshl. (Ann. Natal Mus. v. 1926, p. 241, pl. xv. fig. 4), was omitted from Col. Cat. pars 114, p. 47.

Subfamily *TANYRRHYNCHINÆ.*

Epeigorrhinus mononyx, sp. n.

♂♀. Black, with dense scaling which is grey or pale brownish dorsally, turning to pale greenish laterally below the level of stria 5 on both prothorax and elytra, rarely entirely grey ; underside grey.

Head with the eyes flat and subdorsal, the forehead narrower than an eye and about as broad as the interantennal space. *Rostrum* red-brown, as long as the head and prothorax, curved, almost parallel-sided, with the antennæ inserted at a little behind the middle in both sexes ; the scrobes continued as a broad squamose furrow right up to the eye ; the squamose median dorsal ridge running from the antennæ to the base, only a little broader than a scrobe and almost parallel-sided ; the apical portion flat or very shallowly concave dorsally, squamose except at the extreme apex ; the sides more or less densely squamose, only the median line of the lower surface almost bare. *Antennæ* red-brown, short, the scape only slightly exceeding the hind margin of the eye, the funicle with joint 1 much longer than 2. *Prothorax* nearly twice as broad as long, rounded laterally, broadest close to the base, shallowly constricted at the apex, with the constriction continued across the disk, the base broadly arcuate ; the dorsum quite smooth, the fine shallow confluent punctation entirely concealed by scaling. *Elytra* very broadly ovate, widest at the middle, jointly sinuate at the base, broadly rounded behind ; the punctures in the narrow shallow striæ almost hidden by scaling, striæ 1 and 2 rather strongly curved outwards at the base ; the intervals broad and smooth, with irregular minute spatulate appressed setæ. *Legs* red-brown, with the femora infuscated in the middle and densely squamose ; the tarsi with only a single fine claw.

Length 2·0–2·7 mm., breadth 1·0–1·5 mm.

Cape Province: Aliwal North, 6 ♂♂, 5 ♀♀, xii. 1922, i. 1923 (*R. E. Turner*).

Much the smallest species hitherto described, and distinguished from all its congeners by the posterior position of the antennæ, the shortness of the second funicular joint, the backward prolongation of the scrobes, and the single tarsal claw. This combination of characters might perhaps justify the separation of this species from *Epeigorrhinus* (=*Sympiezorrhynchus*).

Eudraces munroi, sp. n.

♂♀. Black or piceous, with dense submetallic scaling, the legs and antennæ red-brown, prothorax pale coppery, with three very variable whitish or greenish stripes, the median one often obsolete; elytra pale coppery or brassy, with a faint pale green or whitish stripe on intervals 5–7 and sometimes a similar stripe on the suture; underside with dense grey scaling.

Head densely squamose, the forehead nearly twice as broad as the interantennal space, the eyes almost flat. *Rostrum* similar in the two sexes, about as long as the pronotum, parallel-sided, but widening at the base; seen from the side the dorsal outline is on a level with the forehead and straight as far as the antennæ, where it slopes rather steeply downwards; the median dorsal area quite flat, subcarinate laterally, narrowing from the base to the antennæ, with a very fine median carina which is usually hidden by the dense scaling; the scrobes continued right up to the eyes as a very deep broad squamose furrow; underside quite bare, with very fine shallow punctation and two deep longitudinal admedian furrows on the basal third. *Antennæ* inserted at two-fifths from the apex of the rostrum in both sexes; funicle with the two basal joints subequal, the remainder gradually shortening distally, but all longer than broad. *Prothorax* much broader than long, strongly rounded laterally, widest a little behind the middle, not constricted at the apex, which is truncate dorsally and much narrower than the arcuate base; the dorsum gently convex longitudinally, quite smooth, without any median sulcus or carina, the fine confluent punctation being entirely hidden by the round scales and short spatulate appressed setæ. *Elytra* rather broadly ovate and almost of the same shape in the two sexes, but with the extreme apex a little more acuminate in ♀; the striæ very shallow, largely covered by scaling, and appearing only as a very fine line, the punctures more or less visible through the scaling near the base and concealed behind, striæ 1 and 2 curving outwards at the base; the intervals broad and smooth; the scales small, round, convex and contiguous or slightly overlapping, both dorsally and laterally; the appressed setæ subspatulate, multiple and irregular. *Legs* with dense greenish or coppery scaling; the base of the femora and the inner edge of the tibiæ clothed with long soft hairs. *Venter* of ♂ with soft erect hairs down the middle, these being longest on the last ventrite.

Length 5·0–5·7 mm., breadth 2·4–2·6 mm.

TRANSVAAL: Pretoria, 5 ♂♂, 4 ♀♀, iii. 1926 (*H. K. Munro*).

Of the two previously described species, *E. faurei* Mshl., 1926, is a much smaller insect, the rostrum is more abruptly declivous, the elytra are narrower and more acuminate, and the intervals bear only a single row of setæ; *E. flavirostris* Mshl., 1926, may be distinguished by its very short scrobes and the erect setæ on the elytra.

Stereorrhynchus turneri, sp. n.

♀. Derm black, with the apical half of the rostrum, the scape of the antennæ, and the legs testaceous; prothorax fairly densely clothed with pale green scales, with a narrow bare median line; elytra with similar scales, which are sparser dorsally as far as stria 5 and much denser laterally; underside with fairly dense pale green scales throughout.

Head bare and finely aciculate on the vertex, then shiny with coarse irregular punctures and green scaling as far as the eyes, which are quite flat and very closely approximated, the space between them at its narrowest point only as wide as a single scale. *Rostrum* a little longer than the head, slightly narrowing from base to apex, the dorsal outline strongly curved; the basal portion punctate and squamose, the apical part bare, flattened, almost impunctate, and with a shallow median sulcus; underside bare, with fine separated punctures. *Antennæ* with the scape testaceous, the funicle red-brown, and the club infuscate. *Prothorax* transverse (2 : 3), strongly rounded laterally, widest at the middle, very feebly constricted at the apex ; the dorsum gently convex longitudinally, with strong close punctation, which is almost entirely hidden by the transverse scales and appressed spatulate setæ, leaving a bare impunctate median line and a small bare patch on each side behind the middle. *Elytra* broadly ovate, rounded laterally, widest at the middle, shortly produced downwards at the apex ; the shallow striæ containing strong punctures, which are clearly visible on the disk but hidden by scaling in the lateral striæ ; the intervals broad and smooth, each with a row of widely separated minute concealed granules, with rather sparse narrow scales and short suberect curved setæ on the five dorsal intervals, the scales on the lateral intervals broader and much denser and the setæ subrecumbent. *Legs* testaceous, with the femora infuscated in the middle and rather densely squamose ; front tibiæ without any dense fringe of black setæ on the lower edge near the apex, but with a row of four spine-like setæ ; hind tarsi with joint 1 nearly as long as 2+3 and as broad as 3.

Length 3·5–3·9 mm., breadth 1·7–2·1 mm.

Orange Free State : Bloemfontein, 3 ♀♀, iii. 1918. Cape Province : Aliwal North, 4 ♀♀, xii. 1922, i. 1923 (*R. E. Turner*—type).

The genotype, *S. setipennis* Fhs., may be readily distinguished by the long erect setæ on the elytra, which are more numerous and not arranged in a regular row on the intervals ; further, the rostrum is red only at the extreme apex, the eyes are farther apart, and the scales on the disk of the elytra are much shorter.

Further east a smaller form occurs which appears to be a local race of this species.

Stereorrhynchus turneri artisquamis, subsp. n.

♂♀. Differs from the typical form as follows ;—Size smaller ; the eyes a little more widely separated ; the scales much narrower, those on the disk of the prothorax being almost setiform ; joint 1 of the hind tarsi shorter than 3+4 and narrower than 3.

Orange Free State : Modderpoort, 1 ♀, x. 1919 ; Harrismith, 1 ♂, 10 ♀♀, ii.–iii. 1927 (*R. E. Turner*—type) ; Witzieshoek, 6100 ft., 1 ♀, ii. 1929 (*Dr. Hugh Scott*).

Anathresa jordani, sp. n.

♂♀. Black, with dense pale coppery or greenish scaling, gradually becoming paler laterally; the rostrum (except the basal half dorsally), antennæ, tibiæ, and tarsi red-brown.

Head globose, densely squamose, the forehead on a level with the rostrum and about as wide as the inter-antennal space. *Rostrum* similar in the two sexes, a little longer than the head and pronotum, stout, regularly widening from base to apex, the dorsal outline strongly curved, the summit of the curve being in the middle, where the antennæ are inserted; the median dorsal area very broad and almost flat on the apical half, sharply carinate laterally and with an obtuse median carina, rapidly narrowing posteriorly to behind the antennæ, where it gradually disappears, becoming merged in the transversely convex basal portion; the basal half densely squamose dorsally, the apical half with only a few sparse scales and setæ, the underside bare and with sparse fine punctures; the scrobes short, rapidly disappearing behind the antennæ. *Antennæ* rather short, with the scape reaching only to the middle of the eye; funicle with joint 1 as long as 2–4, joints 5–7 transverse, moniliform. *Prothorax* transverse (3 : 5), gently rounded laterally, widest at the middle, shallowly constricted at the apex, truncate at the base, with the external angles rounded; the dorsum smooth, with the fine reticulate punctures entirely hidden by scaling and short appressed spatulate setæ. *Elytra* ovate, widest at the middle, broadly rounded behind, the true apex not being visible from above; the shallow fine striæ containing close punctures that are fully visible; the intervals broad and smooth, with small round contiguous scales and irregular minute spatulate recumbent setæ. *Legs* rather stout, reddish, with the femora fuscous (except at base and apex) and with dense pale scales.

Length 3·0–4·0 mm., breadth 1·5–2·0 mm.

South-West Africa: Hoffnung, 4 ♂♂, 5 ♀♀, i. 1934 (*Dr. K. Jordan*).

Most nearly allied to *A. calva* Mshl., which, however, has the scrobes continued broadly up to the eyes; the antennæ are much longer and more slender, with the scape reaching the hind margin of the eye, the two basal joints of the funicle being equal and the distal joints longer than broad; and the elytra are much more acuminate behind.

Subfamily *Rhytirrhininæ*.

Hypocolobus basuto, sp. n.

♂♀. Derm black, with uniform earth brown indumentum. *Head* very convex, quite smooth, impunctate, and without any trace of supra-ocular ridges. *Rostrum* with a deep impression in the middle of the base and an elevated transverse callus on each side of it; the dorsal area with a shallow median longitudinal sulcus and a broader deeper one on each side, the two intervening costæ broad, smooth, and diverging anteriorly so as to unite with the lateral margin a little beyond the middle; the steeply declivous apical area broadly excavate, with the lateral margins costate, the epistomal carina sharply elevated. *Antennæ* with joint 2 of the funicle a little longer than broad, 3–6 transverse and subequal in length and breadth. *Prothorax* transverse, widening rapidly from the base to well beyond the middle, with the sides almost straight, there abruptly constricted, forming a broadly rounded angulation, the base arcuate, without any basal constriction; the dorsum with three broad deep sulci of equal width reaching from the base to about the middle, the two costæ between them nearly twice as broad as one of the sulci, smooth; bearing an oval depression anteriorly and somewhat elevated obtusely behind, being vertically truncate at the base; the dorso-lateral margins with a round or oval impression at about the middle, the apical half with the usual three large foveæ, the median one shallowly separated from the median basal sulcus; the whole surface smooth and without punctures, but with a few sparse minute black setæ. *Elytra* oblong, jointly sinuate at the base, with the basal angles projecting acutely forwards; the short humeral costa forming a slight obtuse lateral projection, behind which the sides are very shallowly sinuate, and then continue straight and almost parallel to the sharp rectangular prominence at the apex of interval 7; the rows of reticulate foveæ comparatively regular, intervals 3, 5, 7 being more raised than the others; a small obtuse tubercle at the base of interval 1 and a common bifid sutural tubercle in the middle of the declivity projecting horizontally backwards; interval 1 costate, with a raised callus at the base, the costa continuing to the top of the declivity and there ending in a low tubercle, with a slightly larger tubercle a little beyond; the costa on interval 5 beginning at some distance from the base and ending in a low tubercle at the middle, with a smaller tubercle a little beyond it; a large callus near the apex at the junction of intervals 3 and 9, and a smaller one beyond it; the minute black setæ very sparse and recumbent. *Sternum* with a very prominent rounded tubercle on the mesosternum.

Length 4·5–6·0 mm., breadth 2·2–2·9 mm.

BASUTOLAND: 46 examples, 1915 (*Ellenberger*).

Type in the Paris Museum; co-types in the British Museum.

Distinguished by the obtusely angulate prothorax and the horizontal bifid sutural tubercle on the declivity. The most easterly record for the genus, which has not previously been found outside of the Cape Province.

Subfamily *HYLOBIINÆ*.

Chitonopterus stapeliæ, sp. n.

♂♀. Rather shiny black (when abraded), the whole of the pronotum and propleuræ and most of the elytra covered with a white waxy exudation, which may develop into high flocculent masses on the pronotum, before the middle of the elytra and at the top of the posterior declivity; the parts of the elytra not covered with white are a very large lateral triangle with its base along the lateral margin and its apex on the middle of interval 3, and the apical area behind the calli; these latter areas bear a thinner fulvous exudation, which is also usually abraded.

Head closely and very rugosely punctate, with stout recumbent fulvous setæ; forehead much below the level of the base of the rostrum, with a deep median fovea and with an irregular raised granule above it. *Rostrum* of ♂ somewhat longer than the pronotum, subcylindrical, gently curved, strongly convex transversely, sloping down to the forehead at the base, rugosely punctate, with a narrow irregular median carina and two broad punctate sulci on each side, which extend to beyond the middle; rostrum of ♀ much more finely punctate on the apical half, with the median carina obsolete and the lateral sulci reaching only to the middle. *Antennæ* piceous; the funicle with joint 1 as long as 2+3, 3–7 transverse, 7 slightly broader; the club more elongate than usual, elliptical. *Prothorax* about as long as broad, moderately rounded laterally, widest at the middle, shallowly constricted at the apex, the apical margin truncate dorsally and with distinct postocular lobes; dorsum convex longitudinally, highest in the middle, with a short prominent median carina and closely set with small deep reticulate punctures, the edges of some of which (in the middle of the disk and along the dorsal lateral margins) are unevenly raised into low sinuous carinæ. *Scutellum* oblong, transverse, with the lateral margins elevated. *Elytra* with the sides subparallel from the shoulders to beyond the middle, the usual posthumeral prominence on interval 9 being almost obsolete; the dorsal outline rising rapidly for a short distance at the base, then flat to well behind the middle, and rather steeply declivous behind; the shallow striæ with close large subquadrate punctures, the septa between which bear a shiny granule; the intervals narrower than the striæ, convex, somewhat sinuous, with a row of small distant low granules; interval 3 with a small prominent tubercle not far from the base, a lower one in line with it on 5, close behind these another low tubercle on 4, and behind this again another on 3, the posterior calli prominent; interval 1 lower than the others, flat, opaque, and without granules; the setæ on the areas bearing the white exudation suberect and white, elsewhere fulvous and recumbent. *Legs* black (the tarsi sometimes reddish), coarsely punctate, and with stout fulvous setæ.

Length 10–12 mm., breadth 4·7–5·4 mm.

NATAL: Tugela R., Weenen Co., 1 ♂, xi. 1896 (*G. A. K. Marshall*—type); Weenen, 1 ♂, iii. 1929 (*H. P. Thomasset*). TRANSVAAL: Pretoria, 4 ♂♂, 4 ♀♀, iv. 1936 (*H. K. Munro*).

Like *C. solenostemmatis* Peyerh. (Sahara) and *sinaitus* Pic (Sinai), this species seems to be attached to Asclepiads, Mr. H. K. Munro having bred it from *Stapelia* sp. and *Huernia* sp.

This is the first species of the genus described from southern Africa. Its nearest ally is *C. fasciculatus*

Karsch, from West Africa, which is proportionately much shorter, with more ovate elytra; the head is obsoletely punctate, without any median granule, and the forehead is on the same level as the base of the rostrum; the prothorax has no median carina and no postocular lobes, and the elytra lack the tubercles on the basal half.

Chitonopterus stricticollis, sp. n.

♂. Black, moderately shiny (exudation abraded).

Head closely and simply punctate, with fulvous setæ laterally; forehead on a level with the base of the rostrum and with a small median fovea. *Rostrum* as long as the pronotum, gently curved, subcompressed laterally in the basal half, slightly wider beyond the antennæ, very strongly convex transversely in the basal half, coarsely punctate, without any median carina, and with a single deep lateral sulcus. *Antennæ* piceous; joint 1 of the funicle longer than 2+3, 3–7 transverse, 7 broader. *Prothorax* a little longer than broad, with the sides moderately rounded in the middle only, and with a very deep oblique lateral constriction behind the middle, the sides gradually widening from there to the base, the apex broadly but very shallowly constricted, the apical margin strongly arcuate dorsally and without postocular lobes; the dorsum strongly convex longitudinally, highest in the middle, with coarse deep punctures at the base and sides, the discal punctures smaller, and a very short median carina on the anterior half; the pleuræ coarsely punctate except on each side of the very deep oblique sulcus that forms the sub-basal constriction, where the surface is almost impunctate; the setæ on the anterior half of the dorsum curved and suberect, those on the basal half minute and recumbent. *Scutellum* shield-shaped, somewhat elevated, sparsely punctate and setose. *Elytra* ovate, with an angular projection on interval 9 behind the roundly prominent shoulders, and rapidly narrowing to the apex, where there are the usual two small projections; the broad striæ containing large subquadrate punctures which diminish behind; the intervals mostly narrower than the striæ and subcostate, but with a flattened area in the basal third from the suture to interval 3, and interval 6 lower than 5 and 7, a small triangular group of three low tubercles not far from the base on intervals 3, 4, 5, and the posterior calli sharply prominent; the setæ sparse, minute, and recumbent. *Legs* black, with fairly dense subrecumbent setæ, the tarsi red-brown; femora with a sharp tooth; front tibiæ with a broad sublaminate angular projection on the inner edge.

Length 9 mm., breadth 4 mm.

PORTUGUESE E. AFRICA: Beira, 1 ♂, xii. 1901 (*P. A. Sheppard*).

A very distinct species, specially characterized by the non-carinate rostrum, the elongate and sub-basally constricted prothorax, the prominent subhumeral projections, and the dilated front tibiæ.

Subfamily *ANTHONOMINÆ.*

Thamnobius lounsburyi, sp. n.

♂♀. Derm variable in colour, the underside black, the upper side often entirely red-brown, but the pronotum sometimes with indefinite infuscation on the basal half or entirely black, the elytra with the lateral margins normally black and often a blackish suffusion at the base or extending along the suture, rarely the entire upper surface black; the dorsum with separated white scales (easily abraded), which are always dense on the scutellum and usually just behind it; underside with sparse white scales which are dense on the mesosternum and metepisterna.

Head with fine rugose punctation and sparse pubescence; the forehead flat, wider than an eye, with dense suberect white setæ; eyes convex. *Rostrum* stout, shorter than the pronotum (5 : 6), subcylindrical, slightly curved, with the antennæ inserted at one-third from the apex, coarsely punctate, without any median carina, with a smooth area between the antennæ containing a very short shallow stria; colour black, with the apex red-brown, rarely entirely red-brown. *Antennæ* testaceous, the funicle with joint 1 longer than 2, 3–7 transverse and moniliform. *Prothorax* nearly as long as broad, rounded laterally, broadest behind the middle, strongly constricted near the apex, with the constriction continued shallowly across the disk, the slightly arcuate apex much narrower than the truncate base. *Elytra* much wider at the rectangularly rounded shoulders than the prothorax, subparallel-sided from there to the middle, jointly rounded at the apex, without any subapical constriction or posterior calli, truncate at the base; the striæ with distinct close punctures, the intervals broad, smooth, slightly convex, and each with a row of numerous short white erect setæ. *Legs* testaceous, with subrecumbent white setæ; the anterior pairs of femora with a small sharp tooth, that on the hind pair rudimentary.

Length 2·5–2·7 mm., breadth 1·2–1·3 mm.

CAPE PROVINCE: Newlands, Cape Town, 11 ♂♂, 5 ♀♀, on geranium, viii. 1898; Claremont, Cape Town, 9 ♂♂, 4 ♀♀, x. 1892 (*C. P. Lounsbury*).

Rather larger and proportionately narrower than any of the four previously described South African species, from all of which it differs in having broad scales on the elytra. The earlier species have, further, a sharp tooth on the hind femora, except *T. thoreyi* Fhs., in which the legs are black.

Rhynchænus minusculus, sp. n.

♂♀. Dull black, thinly clothed with whitish setæ.

Head finely rugulose, with sparse setæ, the eyes not contiguous. *Rostrum* as long as the head and prothorax, rather narrow, strongly curved near the base, then almost straight, subcylindrical, entirely bare (except for a few whitish setæ at the extreme base), shiny, broadly impunctate dorsally, and with two irregular rows of punctures on each side. *Antennæ* inserted quite close to the base of the rostrum, black, with the scape red-brown and but little longer than the first funicular joint; funicle 6-jointed, 1 as long as 2+3, distal joints not widened except 6, which is transverse. *Prothorax* transverse, feebly rounded laterally, widest behind the middle, shallowly constricted near the apex, which is truncate, the base shallowly bisinuate; the dorsum opaque, finely rugulose, with a forwardly projecting row of isolated setæ along the apical margin, behind this a single row of transverse recumbent setæ, the sparse setæ on the disk comparatively stout, blunt, subrecumbent, and directed backwards, without any projecting lateral fringe of setæ. *Scutellum* sparsely setose, not paler than its surroundings. *Elytra* only slightly wider than the prothorax, narrowly elongate, feebly striate, the punctures in the striæ comparatively large and each with a short recumbent whitish seta; the intervals but slightly wider than the punctures, finely rugulose, each with a single row of rather stout pointed subrecumbent setæ, which are much longer than those in the punctures. *Legs* black, the tarsi piceous; the femora comparatively slender, without spines.

Length 1·0–1·5 mm., breadth 0·5–0·7 mm.

NATAL: Frere, 2 ♀♀, xii. 1892 (*G. A. K. Marshall*). CAPE PROVINCE: Sodium, 3 ♂♂, 3 ♀♀, vii. 1920 (*C. W. Mally*—type); Aliwal North, 1 ♂, 1 ♀, i. 1923 (*R. E. Turner*).

The smallest Curculionid known to me. Its nearest ally appears to be *R. pumilus* Fhs., which, however, is described as having the rostrum rugosely punctate, finely pubescent, and red at the apex.

Subfamily *ALCIDINÆ.*

Alcides sedi, sp. n.

♂♀. Black, with the suture of the elytra and the bottom of the punctures red-brown, with patches of greyish-white scaling; prothorax with a large whitish patch in the basal angles and a narrow median stripe of yellowish scales turning to whitish at the base; elytra with an irregular broad whitish transverse patch a little before the middle lying between striæ 3 and 10 and narrowing at both ends, a more oblique variable narrower macular whitish band behind the middle from stria 10 to stria 1 at the top of the declivity, and a V-shaped whitish mark near the apex, the disk with variable small spots of yellowish or whitish scales; underside with even sparse greyish scaling.

Head closely and strongly punctate, the forehead flattened, without any median fovea. *Rostrum* about as long as a front femur in ♀, a little shorter in ♂, slightly curved, somewhat widened at the apex (more so in ♀), very coarsely and confluently punctate in ♂, the punctures rather less coarse in ♀. *Antennæ* inserted well beyond the middle of the rostrum in both sexes, rather short and stout, joints 4–7 of the funicle transverse. *Prothorax* transverse, rounded laterally, widest close to the base, deeply constricted near the apex, but the constriction not continued across the disk; the apical margin subtruncate dorsally, the postocular lobes feeble; the dorsum almost flat longitudinally in the middle, with very coarse confluent rugose punctation, the narrow intervals subgranulate, the punctures containing short recumbent brown setæ; the scales in the median stripe very narrow and setiform, those in the basal angles plumose. *Scutellum* not enclosed, small, convex, bare. *Elytra* a little wider than the prothorax at the shoulders, and narrowing from there to the apex, distinctly flattened dorsally, the flat area extending to interval 4 at the base and narrowing behind to a point at the top of the declivity, the basal lobes not elevated; the deep striæ containing large unequal and partly confluent punctures; the intervals not broader than the striæ, subcostate, very rugose and subgranulate, interval 1 reaching the base and there widened, 4 wider and more elevated than the others at the base; all the scales narrow, pointed and not plumose, except a few near the lateral margins. *Legs* very rugosely punctate, with sparse narrow or bifid scales; femora with a sharp tooth, that on the front pair much larger and denticulate on its distal edge; tibiæ broad on the apical half and abruptly narrowed basally, but without any distinct tooth, the mucro short but sharp, the uncus rather slender and very sharp.

Length 8·0–9·5 mm., breadth 3·5–4·0 mm.

TRANSVAAL: Pretoria, 6 ♂♂, 6 ♀♀, bred from stems of *Sedum*, iv. 1937 (*H. K. Munro*).

A somewhat isolated species, perhaps coming nearest to *A. laniger* Sparrm., which differs in having the prothorax simply granulate and the front tibiæ with a sharp submedian tooth, the mucro being obsolete; the elytra are more parallel, interval 5 is raised at the base and not 4, etc.

XXI.—*Papers on Oriental* Carabidæ.—XXXIII.

By H. E. ANDREWES.

IN the following pages will be found the descriptions of some further new species from Java, with one species from Timor. Most of the material was collected either by Mr. C. J. Louwerens or by Mr. F. C. Drescher, who have kindly allowed me to retain the types in my collection. The specimens of two species, however, were sent to me by the Amsterdam Zoological Museum, and in these two cases the types are being returned to that Museum.

Oxygnathus javanus, sp. n.

Length 12·5 mm.

Black; palpi, basal joints of antennæ, and tarsi more or less ferruginous.

Head moderately convex, nearly as wide as prothorax, clypeus slightly emarginate, without setæ, a deep sulcus separating it from labrum, clypeal suture obsolete at middle, very fine at sides, frontal plates convex, rounded, unbordered; frontal impressions linear, joining the sides of the clypeal suture in front, diverging a little behind, and joining both the neck constriction and the interrupted grooves which separate the genæ from the vertex; neck constriction rather slight, irregular, and vaguely punctate; no facial carinæ or sulci, but there is on each side a very fine, oblique groove, connecting the frontal impression with the sulcus adjoining the eye and gena; eyes rather flat, with one supraorbital seta, placed far back at the base of the gena, genæ as long as eyes, projecting laterally a little beyond them, and joining neck at right angles; ligula bisetose, produced at apex into a long tooth; palpi long, slender, and glabrous, maxillaries with joint 2 half as long again as 3 and 4, which are about equal, labials with joint 2 quite half as long again as 3; mentum longitudinally striate, with a moderately deep sinus and a short tooth; mandibles curved and slender, as long as head; surface generally smooth and impunctate, but there are a few punctures at sides behind. *Prothorax* about a fourth wider than long, a little contracted in front, the widest point just behind middle, apex slightly emarginate, lateral, apical, basal, and median channels all moderately deep and impunctate, the basal channel slightly interrupted at middle, where the median one passes through it, hind angles each marked by a blunt tooth, which bears the single lateral seta; surface irregularly transversely wrinkled, a line of small vague punctures running down the middle of disk on each side, but not reaching base, the area between the basal channel and the peduncle rugose-punctate. *Elytra* convex, with square shoulders and parallel sides, barely wider than prothorax, twice as long as wide; striæ fairly deep, punctate, deeper and more clearly punctate at sides, 1 to 3 free at base, the outer striæ meeting behind shoulder, a slight striole present, basal border rounding shoulder and reaching base of stria 3, represented by a tubercle at the base of each of the three inner intervals; intervals moderately convex on disk, narrower and more convex at sides, 7 very narrow, 8 formed by a faint and very narrow carina, 3 with three pores at about a third, two-thirds, and four-fifths, all adjoining stria 3, marginal channel closely punctate-tuberculate. Sterna punctate along sides, metepisterna a half longer than wide; venter finely rugose-punctate at sides and apex, the segments transversely sulcate, apical segment with a single seta on each side; protibiæ sulcate on the upper surface.

KEDIRI: Tjampoerdarat (*C. J. Louwerens*), 1 ex.

The absence of facial carinæ and sulci, of the normal clypeal setæ, of the front supraorbital seta, and of the front lateral seta on the prothorax differentiate this species rather widely from the two Indian ones, and may render a new genus necessary. For the present, with a unique specimen before me, I have thought it best to place the species in the genus *Oxygnathus*. It is possible that some of the setæ referred to above have been lost through abrasion.

Clivina leptosoma, sp. n.

Length 5·5 mm.

Piceous-red; palpi, two basal joints of antennæ (rest brown), metafemora, metatibiæ, and all tarsi ferruginous.

Form long and narrow. *Head* with fairly prominent eyes, median part of clypeus a little emarginate, bordered, the angles rounded, as are the wings, which are as far advanced as the median part and separated from it on each side by a slight notch; frontal plates separated from clypeus by a similar notch, convex, bordered, uneven; clypeus depressed in front, clypeal suture deep (but sometimes interrupted); frontal impressions deep and irregular, diverging behind, facial carinæ short but thick, the facial sulci slight; neck constriction deep, minutely punctate; labrum 7-setose, mandibles short, stout, and rather blunt, mentum with a wide pointed tooth, as long as lobes; antennæ moniliform, joint 2 a little longer than 3; surface finely and more or less densely punctate, a pore on vertex. *Prothorax* convex, quadrate, a little wider than head and a little longer than wide, sides parallel, border finely crenulate, marginal channel rugose-punctate, front angles not projecting, hind angles marked on each side by a small tooth, the pore slightly removed from margin, sides of base faintly curved; median line deep, front transverse sulcus rather fine, reaching margin at extremities, surface of disk with some irregular transverse striæ, minutely and not very closely punctate. *Elytra* convex, a little wider than prothorax, more than twice as long as wide, sides parallel, shoulders square; striæ deep, finely punctate, 1 hardly joining 2 at base, 3 quite free, 4, 5, and 6 joining behind shoulder, striole moderately long; intervals convex, tuberculate at base, 3 with four equally spaced elongate pores, adjoining stria 3, 8 carinate at both ends, rounding shoulder in front. Prosternal process sulcate, its episterna transversely striate, the prosternal ridge narrow. Venter finely and closely punctate, the two pores on each side of the apical segment close together. Profemora dilated, longitudinally sulcate beneath, obtusely toothed at apex, the point of the trochanter projecting at base; upper side of protibiæ sulcate, with three long slender digitations and a small upper tooth, meso-tibiæ with a fairly long spur.

In many of its characters the species resembles *C. elongatula* Nietn., but it is smaller and much narrower, piceous red in colour instead of black. Head with the facial carinæ and sulci much less developed, the surface more finely punctate; prothorax much more closely punctate; elytra similar, but with narrower intervals.

KEDIRI: Gambiran, 1 ex. (type); Besoeki, 1 ex.; Bandoeng, 1 ex.; Toeloengagoeng, 2 ex. (all *C. J. Louwerens*). MADIOEN: Mount Pandan (*C. J. Louwerens*), 1 ex. BANJOEMAS; Tjilatjap (*F. C. Drescher*), 4 ex. in the Amsterdam Zoological Museum.

The extent of the puncturation both on the head and on the prothorax is very variable, the specimens differing little in other respects.

Clivina pandana, sp. n.

Length 6–6·5 mm.

Black; palpi and the two basal joints of the antennæ ferruginous, tibiæ and tarsi piceous.

Apart from the larger size and darker colour the species does not differ greatly from *C. leptosoma* just described, but the upper surface is less roughly sculptured. The facial carinæ on the head are finer, there is a transverse depression separating front and vertex (type only), and the surface is smooth, with only some microscopic puncturation. The prothorax is a little contracted in front, the surface is smooth and polished, with hardly any traces of striation and only a few microscopic punctures. The elytra are a little wider, as are the intervals between the striæ. Proepisterna densely punctate.

MADIOEN: Mount Pandan (*C. J. Louwerens*), 2 ex.

Euschizomerus cærulans, sp. n.

Length 13–14 mm.; width 4·25–5 mm.

Underside dark bluish green; head, prothorax, and joint 1 of antennæ dark metallic green; elytra blue; rest of antennæ, palpi, and legs black. Surface shiny, with rather long, scanty pubescence.

Head rather flat, with deep, uneven, frontal foveæ, converging behind, the area between them smooth and convex, labrum deeply emarginate, eyes large and hemispherical, a few irregularly disposed punctures behind and in the foveæ, antennæ reaching basal fourth of elytra, joints 1 and 3 approximately equal in length. *Prothorax* moderately convex, not much wider than head, about as long as wide, base evidently wider than apex, widest at middle, where the sides are obtusely angulate, faintly rounded in front and equally faintly sinuate behind, front angles adjacent to neck, hind ones blunt and inconspicuous; median line fine, but with a depressed area surrounding it, base depressed, basal foveæ near the angles, elongate, parallel, and fairly deep, surface very coarsely, irregularly, and not very closely punctate. *Elytra* convex, ovate, three-fifths wider than prothorax, and as much longer than wide, widest just behind middle, shoulders rather square, sides faintly sinuate at basal third, and again more strongly near apex; striæ moderately deep and very distinctly punctate, both striæ and punctures deeper at sides, striole long and deep; intervals flat on disk, convex at sides, no evident dorsal pores, surface covered with very fine scattered punctures. No microsculpture. Sterna, except the middle of the metasternum, coarsely punctate; venter with some coarse punctures at sides, finely punctate along middle, no evident crenulation along the margins of the segments.

About the same size and shape as *E. metallicus* Har., but the elytra are blue instead of green. On the head the punctures are less numerous; the middle of the front much more convex; the prothorax is similar, but the impressions are all deeper, and the coarse punctures on the surface are not (or hardly) confluent; on the elytra the punctures of the inner striæ are much smaller, as are those of the surface generally.

KEDIRI: Mount Kloet (*F. C. Drescher*), 7 ex. The type is in the Amsterdam Zoological Museum.

Callistomimus cyclotus, sp. n.

Length 6 mm.; width 2·6 mm.

Black; head dark bluish green; palpi, joints 1 to 3 of antennæ, and legs mainly flavous; prothorax and an area round the scutellum, extending outwards at base to the fourth stria, and backwards just beyond the front elytral fascia, but continued along the sutural intervals to the hind fascia, dark red; elytra with two fasciæ, at about a fourth and two-thirds respectively from base, extending to the epipleura and narrowing from without inwards, and a common spot at extreme apex, yellowish white; the front fascia is transverse and extends inwards to stria 2, the hind one is a little oblique and runs forward to the suture. Surface pubescent.

Head rather flat, closely punctate, eyes small, convex. *Prothorax* very convex, cordate, a fourth wider than head and a fourth wider than long, widest a little behind middle, base as wide as apex, produced backwards at middle, sides strongly rounded in front, sinuate close to the hind angles, which project backwards on each side as a sharp acute tooth; median line faint, surface closely confluently punctate. *Elytra* convex, slightly dilated behind, shoulders rather square, a little more than a half wider than prothorax, just a half longer than wide; striæ finely punctate, intervals a little convex, surface finely but not closely punctate, much more finely than the head and prothorax. Microsculpture of the elytra isodiametric, none visible on the head or prothorax. Sterna punctate, venter finely punctate.

The pattern on the elytra is very similar to that of *C. nair* Maindr., but that species is a good deal smaller, the head and prothorax more finely punctate, and a larger red area on the disk of the elytra. The two species will stand next each other in my key to the Oriental species of the genus (1921, Proc. Zool. Soc. Lond. p. 237).

TIMOR: Lion Mountain (*Doherty*), 1 ex. in my collection.

I take the opportunity of correcting here a mistake in my description of *Callistomimus pernix* (Ceylon Journ. Sci. (B), xix. 1936, p. 203), the width of which is actually 2·25 mm., not 3·25 mm.

Callistomimus alternans, sp. n.

Length 5·5–6 mm.

Black; palpi, joints 1 to 3 of antennæ, legs, and a pattern on the elytra flavous. There are four spots on each elytron, viz., (i.) a small transverse spot a little behind shoulder on intervals 6 to 8, (ii.) a similar spot towards apex, (iii.) a very small spot on interval 4 opposite the shoulder-spot, (iv.) another very small spot on interval 2 close to apex.

Head convex, closely rugose-punctate, clypeus and a small area on vertex smooth, eyes rather small but prominent. *Prothorax* convex, cordate, nearly a third wider than head, fully a third wider than long, base as wide as apex, sides strongly rounded in front, sinuate a little before base, the hind angles projecting backwards on each side as an acute tooth (as in *chalcocephalus*); median line distinct, but confined to disk, basal foveæ fairly deep, surface closely punctate. *Elytra* convex, subovate, shoulders rounded but evident, a half wider than prothorax, a third longer than wide; striæ moderately deep and clearly punctate; intervals moderately convex, the even ones slightly raised and nearly twice as wide as the odd ones; surface closely punctate, much more finely than the head and prothorax. Microsculpture of the elyta isodiametric, none visible on the head or prothorax. Body beneath punctate, chiefly at sides, the venter more finely than the sterna.

Nearly related to *C. chalcocephalus* Wied., but with much smaller spots on the elytra; it will be readily distinguished from all other eastern species by the alternately wide and narrow intervals of the elytra.

SEMARANG: Mt. Oengaran (*F. C. Drescher*), 24 ex. The type is in the Amsterdam Zoological Museum.

Callistomimus chalcocephalus Wied. Zool. Mag. ii. 1, 1823, p. 57; Andr. Proc. Zool. Soc. 1921, pp. 236 & 238, t. i. fig. 1.

Var. *obsoletus*, nov.

This well-known species was redescribed by Bates under the name of *Pristomachærus messii*, and it is figured at the end of my paper quoted above. The type was reputed to come from Java, but the only example of the typical form which I have seen from the Malay Archipelago came from Krakatau. There is considerable variation in specimens from India, Burma, Indo-China, and China, but in none of them are the elytral spots so much reduced in size as in the series of examples now before me. In these the humeral flavous spot is small and elongate, occupying only intervals 8 and 9, with the marginal channel adjoining, and the epipleuron, though occasionally there is a vestige of colour on intervals 6 and 7; the hind spot is transverse and placed on intervals 4 to 8, the portions on 4, 5, and 7 very small, those on 6 and 8 slightly longer. In other respects the variety resembles the type-form.

KEDIRI: Toeloengagoeng (*C. J. Louwerens*), 11 ex.

Oodes melanodes, sp. n.

Length 8·5 mm.; width 3·75 mm.

Black, very shiny; palpi, antennæ, and legs, except base of femora, trochanters, and coxæ, more or less ferruginous. Surface very smooth, impunctate.

Head a little convex, neck slightly constricted, eyes very large and prominent, labrum sex-setose, clypeus bisetose, clypeal suture lightly impressed, and on each side of it a short, deep, oblong impression, directed outwards in front towards the base of the mandible, antennæ slender, extending a little beyond the base of the elytra, palpi subtruncate, mentum with a short simple tooth, beneath which is a pair of long setæ. *Prothorax* moderately convex, nearly twice as wide as head, four-fifths wider than long, widest just before base, strongly contracted in front, apex emarginate, bordered at sides, sides gently rounded, finely bordered up to a point just before base, hind angles right but slightly rounded, a minute pore and seta on each side close to them but on the basal margin; median line extremely fine, basal foveæ vague, lightly impressed, reaching base, a slight oblique depression on each side, directed from middle of base forwards and outwards. *Elytra* rather flat, elliptical, as wide at base as prothorax but slightly dilated behind, two-fifths longer than wide, sides distinctly sinuate before apex, basal border minutely dentate at shoulder, continued to base of stria 1; striæ deep, deeper at sides, clearly punctate on basal half, minutely crenulate behind, 1 and 2 arising in an umbilicate pore, the inner striæ finer towards apex; intervals rather flat on disk and behind, convex at sides, the inner wider than the outer intervals, 8 hardly narrower than 7, its inner margin subcostate, 9 very narrow, disappearing near base and apex. Microsculpture on head and disk of prothorax isodiametric, the elytra with fine transverse lines, which form wide irregular meshes. Prosternal process unbordered, the declivity subcarinate, metasternum and metepisterna rather feebly punctate, metepisterna a little longer than wide, outwardly sulcate, apical ventral segment with a single seta on each side in the ♂, two in the ♀; protarsi ♂ with three widely dilated joints.

The species appears to be very near *O. sulcatus* Eschsch. from the Philippine Is., which I redescribed from the unique type in 1928 (Trans. Ent. Soc. Lond. p. 20), but it is a little smaller, the antennæ and legs ferruginous, the proportions of the various parts of the body dissimilar, as are the forms of the frontal foveæ, basal impressions of the prothorax, and striæ and intervals on the apical half of the elytra.

Madioen: Mount Pandan, 3 ex. Kediri: Penampean, 2 ex. (all *C. J. Louwerens*).

Patellus obesus, sp. n.

Length 4·5 mm.

Piceous beneath; upper surface black, very shiny, and somewhat iridescent; palpi and joints 1 to 3 of antennæ pale ferruginous, legs dark ferruginous.

Head small, convex, frontal foveæ short, moderately impressed, diverging behind, a slight longitudinal linear impression on vertex, eyes rather flat, enclosed by genæ behind, antennæ just reaching base of elytra. *Prothorax* convex, two-thirds wider than head, about a half wider than long, widest slightly before middle, base bisinuate, its sides directed a little backward, wider than apex, front angles a little rounded, sides well rounded in front, straight behind, narrowly bordered, a large setiferous pore at middle, none behind, hind angles right and fairly sharp; median line fine, not reaching extremities, transverse impressions obsolete, basal foveæ faint, surface very smooth. *Elytra* convex, oval, a fourth wider than prothorax, a third longer than wide, base bordered on each side from shoulder up to a point opposite stria 2, where it ends in an umbilicate pore, shoulders evident, sides rounded, a slight sinuation on each side before apex; seven dorsal striæ, 8 and 9 merged in the marginal channel (though on the right side there are one or two punctures near base on interval 7), the striæ moderately deep and very clearly punctate, none reaching base, 2 commencing a little further from base than the rest, no scutellary striole, intervals slightly convex, no dorsal pores, surface very smooth. Microsculpture formed by extremely fine and closely placed transverse lines.

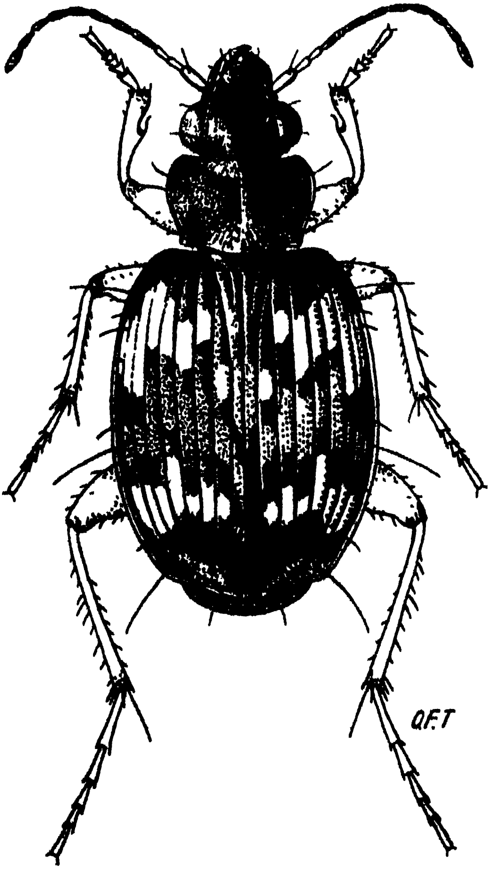
A little larger and evidently wider than *P. flavipes* Motch. (=*drimostomoides* Chaud.), the eyes rather more prominent, the prothorax wider and with even slighter basal foveæ, the elytra wider, with more rounded sides, the striæ deeper, and much more conspicuously punctate.

Kediri: Besoeki (*C. J. Drouwerens*), 1 ex., ♀.

Tetragonoderus linealis, sp. n.

Length 5 mm.

Black; palpi, three basal joints of the antennæ, and legs flavous; head and prothorax bronze-black, sericeous; elytra with a dull surface and a tessellated pattern, as shown in the accompanying illustration, in which the white parts have a yellowish tinge and the shaded parts are brown, the black parts with a bronze tinge near apex only.



Tetragonoderus linealis, sp. n.

Head smooth, with short, shallow, frontal furrows, eyes prominent, antennæ extending only a little beyond base of elytra. *Prothorax* subcordate, a fourth wider than head, nearly a half wider than long, widest at a fourth from apex, base a little produced at middle, oblique at sides, slightly wider than apex, sides bisetose, with a narrow, reflexed border, rounded in front, vaguely sinuate just before the hind angles, which are moderately sharp but obtuse; median line deep on disk, but only visible between the transverse impressions, which are well marked at middle, basal foveæ small but fairly deep, surface with some vague cross-striation, middle of base longitudinally striate. *Elytra* moderately convex, oval, four-fifths wider than prothorax, a third longer than wide, the base emarginate, the apex truncate, and somewhat emarginate on each side; striæ moderately deep and finely crenulate, shallower at sides and apex, intervals slightly convex on disk, 3 a little wider than the others near base and with two dorsal pores. Microsculpture of the elytra very distinct, consisting of oblique lines which form wide irregular meshes; on the head and prothorax it is equally distinct but much finer, the meshes more or less isodiametric, at least at middle. Prosternal process rounded, unbordered at apex; claws only vaguely denticulate.

Larger and with a duller surface than *T. andrewesi* van Emd., the only other described Javanese species, the prosternal process unbordered, the legs pale throughout, and a good deal of brown colour on the disk of the elytra. As the ♂ is at present unknown the species cannot yet be placed in Chaudoir's table (Bull. Mosc. 1876, ii. pp. 33–68).

Kediri: Mount Kloet (*C. J. Louwerens*), 1 ex., ♀.

Brachyctis rugulosa Chaud., Ann. Soc. ent. Belg. xii. 1869, p. 252.

Var. *cathara*, nov.

Chaudoir's species is common in the Malay region, and in the typical form has two large, rounded, ferruginous spots on each elytron. In the four specimens which I have before me these spots are wanting, so that the elytra are uniformly black and, as in the type-form, closely pubescent; the striæ are a little less evident and the puncturation slightly finer.

Kediri: Toempoek, 1 ex.; Samberbajem, 1 ex. (both *C. J. Louwerens*). Semarang: Mt. Oengaran (*F. C. Drescher*—Amsterdam Zool. Mus.), 2 ex.

Apristus louwerensi, sp. n.

Length 3·75 mm.

Æneous above, æneous-black beneath, metasternum, trochanters, and coxæ dark red. Surface minutely punctate ; head, prothorax, and apex of elytra moderately shiny, rest of elytra dull. Elytra and underside very sparsely pubescent.

Head wide, frontal foveæ short and slight, some traces of striation at sides, eyes moderately prominent, antennæ reaching basal third of elytra. *Prothorax* convex, cordate, barely wider than head, a fourth wider than long, widest not far from apex, base slightly produced at middle, oblique at sides, a little narrower than apex, sides bisetose, rounded in front, faintly sinuate before the hind angles, which project a little on each side as a moderately sharp tooth ; median line deep, basal foveæ only moderately impressed, puncturation more evident than that on head and elytra, especially so on the basal area. *Elytra* rather flat, subquadrate, three-fourths wider than prothorax, rather less than a half longer than wide, apex truncate ; striæ shallow, inconspicuously punctate, intervals slightly convex, 3 with two very inconspicuous pores adjoining stria 3. Microsculpture isodiametric and very distinct throughout.

In my key to the Indian species of the genus (Ann. & Mag. Nat. Hist. (10) ix. 1932, p. 143) this one would come alongside *A. subtransparens* Motch., but it is rather wider, with more prominent eyes, the elytra æneous and more evidently striate.

KEDIRI : Samberbajem (*C. J. Louwerens*), 16 ex.

Pentagonica eurodes, sp. n.

Length 5 mm.

Ferruginous, moderately shiny ; head and elytra black, but joint 1 of the antennæ and the elytral suture are more or less piceous, the elytral marginal channel ferruginous.

Head rather flat, frontal impressions short but deep, eyes large, hemispherical, genæ inconspicuous, continuing the outline to neck, which is deeply constricted, a slight transverse depression between front and vertex, antennæ stout, extending a little beyond base of elytra. *Prothorax* convex, pentagonal, a fifth wider than head, nearly twice as wide as long, base produced at middle, apex slightly emarginate, bordered, front angles rounded, sides slightly explanate and reflexed, angulate at about middle, with a pore and seta on the angle, a little rounded in front, straight behind, but bent a little inwards before the basal constriction; median line slight, basal sulcus deep, surface smooth and impunctate. *Elytra* convex, nearly twice as wide as prothorax, rather more than a fourth longer than wide, widest just behind middle, shoulders square, sides gently rounded, apex truncate; striæ lightly impressed, finely but indistinctly punctate, intervals slightly convex on disk, three small dorsal pores, surface uneven but impunctate. Microsculpture isodiametric throughout.

Very much like *P. ruficollis* Schm.-Goeb., but with pale antennæ; the eyes are more prominent, the produced part of the base of the prothorax behind the sulcus is only half the width of the second elytral interval (equal to it in *ruficollis*), and the elytra are relatively shorter.

KEDIRI: Samberbajem, 2 ex.; Ngoenoet, 2 ex.; Toeloengagoeng, 1 ex. (all *C. J. Louwerens*). VERLATEN ISLAND (*Dammerman*—Buitenzorg Mus.), 1 ex.

Lebia bella, sp. n.

Length 4·5–5 mm.

Ferruginous; joints 4 to 11 of antennæ and elytra black, but the border and epipleura of the elytra are ferruginous, and each elytron bears two flavous spots, viz., (i.) a fairly large irregular oval spot in front on intervals 3 to 6, the pale colour carried furthest forward on interval 5, and (ii.) a smaller rounded spot close to apex on intervals 2 to 4, a little removed both from the border and suture.

Head rather flat, frontal foveæ small and rounded, eyes prominent, surface minutely punctate. *Prothorax* convex, a fifth wider than head, a third wider than long, base evidently wider than apex, strongly produced at middle, sides bisetose, slightly reflexed, rounded in front, straight behind, a little explanate, more widely behind, hind angles right; median line and front transverse impression shallow, hind transverse impression deep, surface minutely punctate. *Elytra* convex, a little more than twice as wide as prothorax, two-fifths longer than wide, widest a little behind middle, apex truncate, the outer angles rounded; striæ fairly deep, finely crenulate, intervals moderately convex, 3 with two pores adjoining stria 3 at a fourth and three-fourths respectively, surface minutely punctate. Microsculpture of elytra isodiametric, none on head or prothorax. Venter punctate and setulose; tarsi with joint 4 bilobed, claws pectinate, with four teeth on each side.

Very near the Sumatran species *L. clarissa* m., but the head is ferruginous, the legs are entirely ferruginous, and the apical spot on the elytra does not touch either margin or suture.

KEDIRI: Tembohan, 1 ex.; Bandoeng, 1 ex.; Zuider Geb., 1 ex. (all *C. J. Louwerens*). BANJOEMAS: Djeroeklegi, 2 ex. (*F. C. Drescher*).

XXII. *New Species of* Lymantriidæ (*Lepidoptera Heterocera*) *from the Haut Katanga and other Localities.* By C. L. COLLENETTE, F.R.E.S.

[Plate IX.]

I HAVE received for determination, from Dr. Jean Romieux and Dr. G. E. Audeoud, both of Geneva, two collections of African Lymantriidæ. Among these insects there is a high proportion of new and interesting species, which are described in this paper.

The insects taken by Dr. Romieux are all from the Haut Katanga of the Belgian Congo, in the dry forest zone of openly spaced trees, little undergrowth, and a cover of tall grass. The three localities of Tshinkolobwe, Panda, and Tshituru are situated in a relatively rich vegetation of this type, at an elevation of 1200–1350 metres, that of Sakania in a medium type at 1200 metres, and that of Midingi in a poor type at 1500 metres. With very few exceptions the insects were taken at electric light.

Types are in the collections of Drs. Romieux and Audeoud, and paratypes where available have been kindly presented to the British Museum (Natural History).

Marblepsis ochrobasis, sp. n. (Pl. IX. fig. 1.)

♂.—Palpus orange-buff. Antennal shaft light buff, pectinations slightly darker. Head, thorax, and abdomen, above and beneath, light buff, frons orange-buff. Legs orange-buff to pale orange-yellow. Wings and fringes, above and beneath, whitish; both wings suffused in the basal area with pale yellow-orange, on the underside more deeply than on the upper.

♀.—Resembles the ♂.

Expanse, ♂♂ 43–45 mm., ♀ 54 mm.

1 ♂ (holotype), 1933, Tananarivo, 1 ♂ (paratype), 1923, Madagascar, both *G. E. Audeoud*; also, in the British Museum Collection, 1 ♀ (allotype) and 1 ♂ (paratype), April 1922, south of Madagascar (*M. Lamberton*).

This species may be distinguished by the pale yellow-orange suffusion at the base of the wings. In addition, *Marblepsis xanthoma* Collenette has the antennal shaft white and the pectinations fuscous, while in *Marblepsis chionoptera* Collenette the antennal shaft is considerably longer, the shaft sayal-brown and the pectinations fuscous.

Euproctis panda, sp. n. (Pl. IX. fig. 14.)

♂.—Antennal shaft light buff, the pectinations warm buff. Palpus, head, thorax, and abdomen pale orange-yellow, the outer side of the palpus darker. Pectus, venter, and legs light buff, mixed on the fore leg with pale orange-yellow. Fore wing cream-colour, crossed by four broad and indistinct fasciæ, roughly parallel with the termen, of pale orange-yellow: a conspicuous round spot of orange-rufous on the centre of the discocellulars; a similar but smaller spot subterminally between veins *M*1 and *M*2, and a double spot between vein *Cu*2 and the anal vein; fringe cream-colour. Hind wing and fringe ivory-yellow, the inner marginal area lightly tinged with massicot-yellow. Underside of both wings, and fringes, ivory-yellow.

Expanse, ♂, 36 mm.

1 ♂ (holotype), Panda, 9th February, 1930 (*J. Romieux*).

This species has the fore wing marked much as in *Euproctis rufopunctata* Walker, but coloured as in a rather dark specimen of *E. proxantha* Holland.

Euproctis audeoudi, sp. n. (Pl. IX. fig. 11).

♂.—Antenna ochraceous-buff. Palpus, head, thorax, and abdomen ochraceous-tawny, the frons somewhat lighter, and some long spatulate fuscous scales on the tegula. Pectus, venter, and legs ochraceous-buff. Fore wing ochraceous-buff; a very broad medial band of interneural fuscous irroration, occupying a third of the lower half of the wing and extending more narrowly to the costa, the proximal margin bowed with concavity basad; a narrow band of interneural fuscous irroration leaving the medial band at the origin of veins *M*3 and *Cu*1, and running almost straight to the apex; along the inner margin some long spatulate fuscous scales, not entirely confined to that part of the margin touched by the medial band; a series of faint interneural fuscous patches subterminally, stronger towards the apex, obsolete between veins *M*3 and *Cu*1; fringe ochraceous-buff. Hind wing pale yellow-orange, inner marginal area and fringe somewhat darker. Underside of both wings, and fringes, pale yellow-orange.

Expanse, ♂♂, 43–44 mm.

1 ♂ (holotype), 18th July, 1925, and 2 ♂♂ (paratypes), 17th May and 23rd July, 1925, Kampala, Uganda (*G. E. Audeoud*).

Resembles *Euproctis ceramozona* Collenette, but considerably larger and darker, and with the medial band on the fore wing broader from the costa to the lower margin of the cell.

Euproctis stenoptila, sp. n. (Pl. IX. fig. 10.)

♂.—Antenna orange-buff. Palpus, head, body, and legs light orange-yellow. Fore wing and fringe, above and beneath, pale orange-yellow; hind wing and fringe, above and beneath, light orange-yellow.

Expanse, ♂♂, 36 mm.

1 ♂ (holotype) and 2 ♂♂ (paratypes), Tshinkolobwe, 25th and 26th September, 1930, and 15th October, 1931 (*J. Romieux*).

The long and narrow fore wing and the contrast in colour of fore and hind wing serve to distinguish this insect from any other species of the genus.

Porthesaroa maculata, sp. n. (Pl. IX. fig. 2.)

♂.—Palpus ochraceous-tawny. Antennal shaft whitish, pectinations tawny-olive. Head whitish mixed with fuscous; a few hair-scales of capucine-yellow on the frons. Thorax whitish, marked with several rounded spots of fuscous. Basal segments of abdomen whitish, distal segments capucine-yellow, anal tuft pinkish buff. Pectus, venter, and legs whitish, mixed on the legs with capucine-yellow and fuscous. Fore wing snuff-brown mixed with whitish, with a pattern of interneural fuscous spots, which are arranged very much as in *Porthesaroa lacipa* Hering, with the exception that the two spots below the cell, between the sub-basal fascia and the base of the wing, are further apart, and that the subterminal fascia is more even, and near the inner margin swings round towards the postmedial fascia; fringe snuff-brown mixed with whitish. Hind wing pale pinkish buff, with a faint snuff-brown subterminal fascia; fringe pale pinkish buff. Underside of fore wing, and fringe, snuff-brown. Underside of hind wing pale pinkish buff, with a patch of snuff-brown on the discocellulars and a faint snuff-brown subterminal fascia; fringe pale pinkish buff.

♀.—Resembles the ♂, but with the upper side of the hind wing considerably darker.

Expanse, ♂ 22 mm., ♀ 29 mm.

1 ♂ (holotype), 9th November, 1930, 1 ♀ (allotype), 24th November, 1930, Tshinkolobwe (*J. Romieux*); 1 ♂, October–December, 1909, Makulane, south of Lorenço Marques, Mozambique (*G. E. Audeoud*).

Easily distinguished from *Porthesaroa lacipa* Hering by the colour of the hind wing in the ♂, which is greyish white and not yellow.

Aroa interrogationis, sp. n. (Pl. IX. fig. 4.)

♂.—Palpus sayal-brown. Antennal shaft light pinkish cinnamon, pectinations pinkish buff. Head and thorax amber-brown. Abdomen above and beneath, and pectus, pinkish buff mixed with tawny-olive. Legs sayal-brown mixed with light pinkish cinnamon. Fore wing ochraceous-tawny; an argus-brown subbasal fascia, running from the costa almost to the anal vein; a very broad amber-brown antemedial fascia, edged proximally with whitish, slightly bowed with concavity basad; an argus-brown mark on the discocellulars, which on the left wing has the shape of a question-mark; a very broad amber-brown postmedial fascia, edged with argus-brown, its proximal edge almost straight, its distal edge wavy; a wavy argus-brown subterminal fascia; a fuscous terminal line;

fringe ochraceous-tawny. Hind wing tawny-olive, with a faint snuff-brown mark on the discocellulars and traces of dark postmedial and subterminal fasciæ; a fuscous terminal line; fringe ochraceous tawny. Underside of fore wing, and fringe, ochraceous-tawny; a fuscous mark on the discocellulars and an almost straight fuscous postmedial fascia, running inwardly oblique from the costa to vein *Cu2*; a fuscous terminal line. Underside of hind wing, and fringe, ochraceous-tawny; a fuscous mark on the discocellulars and an almost straight fuscous postmedial fascia, which does not reach the inner margin; a fuscous terminal line.

♀.—Resembles the ♂.

Expanse, ♂♂ 32–34 mm., ♀♀ 31–35 mm.

1 ♂ (holotype), 26th February, 1935, and 1 ♀ (paratype), 18th July, 1925, Kampala, Uganda (*G. E. Audeoud*). In British Museum Collection, 1 ♀ (allotype), 18th October, 1936, and 2 ♀♀ (paratypes), 22nd September, 1930, and 29th September, 1936 (*H. Hargreaves*), and 1 ♂ (paratype), 4th February, 1931 (*G. L. R. Hancock*), all Kampala, Uganda. Also 1 ♂, 5000 ft., November 1921, Kissenyies, Ruanda District, Kivu (*T. A. Barns*).

Although the sexes are alike in this species I have no hesitation in placing it in the genus *Aroa*, as it agrees well in structure.

A ♀ in the British Museum Collection, taken by myself at Macenta, French Guinea, 2,000 ft., May 1926, appears to be indistinguishable from Uganda specimens.

Lælia pyrrhothrix, sp. n. (Pl. IX. fig. 6.)

♂.—Antennal shaft cinnamon-rufous, pectinations drab. Palpus, head, and thorax tawny, the abdomen darker. Pectus and abdomen salmon-buff to pinkish buff. Legs cinnamon-rufous mixed with snuff-brown and pinkish buff. Fore wing orange-cinnamon, irrorated lightly and evenly over the whole wing with fuscous; a fuscous antemedial fascia running from the costa at one-third, bent inwardly in the cell and on the anal vein, and reaching the inner margin at right angles; two faint streaks of fuscous on the discocellulars; an almost straight fuscous postmedial fascia, running from vein *R4* to the inner margin at two-thirds; a fuscous preterminal fascia, interrupted at the veins; fringe orange-cinnamon mixed sparsely with fuscous. Hind wing snuff-brown with a slight admixture of salmon-colour in the inner marginal area; fringe salmon-colour, lighter distally. Underside of both wings, and fringes, salmon-colour, irrorated lightly with fuscous in the apical area of both wings and along the costa of the fore wing.

♀.—Resembles the ♂, but with less fuscous irroration on the fore wing and with a considerably lighter hind wing.

Expanse, ♂♂ 29–35 mm., ♀♀ 34–36 mm.

1 ♂ (holotype), 24th December, 1930, 1 ♀ (allotype), 22nd August, 1930, and 6 ♂♂, 1 ♀ (paratypes), October 1930, January, March, May, and July 1931, all taken at Tshinkolobwe; 1 ♂, 2 ♀♀ (paratypes), October, November, and December 1929 (Panda); 1 ♂ (paratype), June 1930, Midingi; all taken by *J. Romieux*. Also 1 ♂, N. Rhodesia, 1912 (*L. Lloyd*), in the British Museum Collection.

This species is intermediate in some respects between *Lælia* and *Dasychira*, but I have decided to place it in the former genus on the evidence of general appearance, well-developed antennæ, the long and thin third segment of the palpus, and the shape of the process on the fore tibia, which is long and curved outwardly at the tip.

It is of interest that the dates of capture of the above series of thirteen specimens covers all the months of the year excepting February, April, and September.

Dasychira katanga, sp. n. (Pl. IX. fig. 3.)

♂.—Palpus pinkish buff, on the outer side bistre. Antennal shaft snuff-brown mixed with fuscous, pectinations fuscous. Head, thorax, and abdomen drab mixed with snuff-brown; a dorsal line of fuscous on the vertex and patagium, some fuscous hair-scales on the tegula, and fuscous dorsal tufts on the basal segments of the abdomen. Pectus and venter pinkish buff to pale pinkish buff. Legs pinkish buff mixed with bistre. Fore wing snuff-brown; a rather indistinct fuscous antemedial fascia, with a fuscous streak above the anal vein from the fascia to the base of the wing; discocellulars edged faintly with fuscous; a rather indistinct fuscous postmedial fascia, from the costa at three-fourths, curving round the discocellulars to vein *Cu2*, thence running at right angles to the inner margin; a conspicuous fuscous streak running oblique inwardly across the tornal area from below vein *M*3 to just above the anal vein, where it almost touches the postmedial fascia; a fuscous preterminal fascia, parallel with the termen; fringe snuff-brown, mixed with fuscous interneurally. Hind wing pale pinkish buff, mixed in the terminal area with snuff-brown; fringe pale pinkish buff mixed with snuff-brown. Underside of fore wing and fringe pinkish buff; underside of hind wing and fringe somewhat lighter.

♀.—Resembles the ♂, but with a darker hind wing.

Expanse, ♂ 46 mm., ♀♀ 43–59 mm.

1 ♂ (holotype), 14th February, 1931, 1 ♀ (allotype), 12th August, 1931, 3 ♀♀ (paratypes), July and August (2), 1930 and 1931, Tshinkolobwe; 1 ♀ (paratype), 7th February, 1932 (Sakania); 1 ♀ (paratype), 25th November, 1929 (Chituru); 2 ♀♀ (paratypes), September 1929 and February 1930 (Panda); all taken by *J. Romieux*.

May be placed near to *Dasychira ruptilinea* Holland.

Dasychira dasynota, sp. n. (Pl. IX. fig. 5.)

♂.—Palpus pinkish buff, on the outer side bistre. Antennal shaft tawny-olive, the pectinations slightly darker. Head, thorax, and abdomen cinnamon-buff mixed with snuff-brown and bistre, and with fuscous-black dorsal tufts on the basal segments of the abdomen. Pectus, venter, and legs pinkish buff, mixed sparsely on the legs with bistre and fuscous-black. Fore-wing snuff-brown, with lighter patches of pinkish buff, and irrorated unevenly with bistre; a prominent bistre streak, running above the anal vein from the base of the wing to the termen, broken between the antemedial and postmedial fasciæ; a faint bistre antemedial fascia running from the costa at one-half to the inner margin at one-half, which it joins at right angles; a curved bistre streak on the discocellulars, concavity terminad; a faint bistre postmedial fascia from the costa at two-thirds to the inner margin at two-thirds, the portion between vein *Cu*1 and the inner margin almost straight and running at right angles to the margin; between the antemedial and postmedial fasciæ the area is rather more evenly irrorated, giving in some specimens the appearance of a broad band across the wing; a bistre subterminal fascia, produced to the termen interneurally between veins *R*5 and *M*1 and also *M*3 and *Cu*1 ; fringe pinkish buff, bistre interneurally. Hind wing and fringe pinkish buff, with a faint dark shade running from apex to anal angle. Underside of fore wing pinkish buff; a prominent snuff-brown patch on the discocellulars, a faint postmedial fascia of the same colour, and some sparse irroration in the apical area and along the distal half of the costa ; a snuff-brown line along the termen ; fringe pinkish buff, bistre interneurally. Underside of hind wing pinkish buff ; a snuff-brown patch on the discocellulars ; traces of a postmedial and a subterminal fascia ; a snuff-brown line along the termen ; fringe pinkish buff, mixed interneurally towards the apex with snuff-brown.

♀.—Resembles the ♂, but with upper side of fore wing somewhat lighter and upper side of hind wing somewhat darker.

Expanse, ♂♂ 37–39 mm., ♀ 41 mm.

1 ♂ (holotype), 10th October, 1931 ; 1 ♀ (allotype), 8th November, 1930 ; 3 ♂♂ (paratypes), August and November, 1930, and March 1931, Tshinkolobwe (*J. Romieux*).

Nearest to *Dasychira jacksoni* Collenette and *D. ruptilinea* Holland.

Dasychira chlororhina, sp. n. (Pl. IX. fig. 12.)

♂.—Palpus tawny-olive. Antennal shaft tawny-olive, the pectinations darker. Head and thorax tawny-olive to snuff-brown, the lower half of the frons pale pinkish buff. Abdomen Saccardo's-umber, with fuscous-black dorsal tufts on the basal segments. Pectus, venter, and legs pinkish buff, mixed on the legs with tawny-olive and snuff-brown. Fore wing snuff-brown, with a soft blue-violet sheen in certain lights ; an indistinct bistre subbasal fascia ; an indistinct bistre antemedial fascia from the costa at one-third to the inner margin at one-third, apparently crenate, points on the veins, concavities basad ; some faint bistre markings on the discocellulars ; a bistre postmedial fascia, crenate throughout, points on the veins, concavities terminad, running from the costa at three-fourths, slightly bowed with convexity terminad, to vein *Cu*1, thence bowed with concavity terminad to the inner margin ; some indistinct lighter interneural markings between the postmedial and subterminal areas ; a bistre subterminal fascia, broken at the veins ; fringe snuff-brown. Hind wing pinkish buff, with a narrow line of snuff-brown along the termen ; fringe light drab tipped with whitish. Underside of fore wing light drab ; traces of a darker patch on the discocellulars, and of a postmedial fascia parallel with the termen ; fringe light drab, darker interneurally. Underside of hind wing rather lighter than the upper side ; fringe as on upperside.

♀.—Resembles the ♂, but with markings on fore wing less well defined, and a rather darker hind wing.

Expanse, ♂ 30 mm., ♀ 39 mm.

1 ♂ (holotype), 5th July, 1931, 1 ♀ (allotype), 13th February, 1931, Tshinkolobwe (*J. Romieux*).

Dasychira melarhina, sp. n. (Pl. IX. fig. 15.)

♂.—Rather closely resembles *Dasychira chlororhina* described above, but is certainly distinct. The ground-colour of the fore wing is tawny-olive, without blue-violet sheen ; in the postmedial fascia the crenations are considerably deeper than in *D. chlororhina*, and a rather prominent dark streak runs from the centre of vein *Cu*1 to the inner margin, bordered distally with pinkish buff.

Expanse, ♂♂, 32–33 mm.

1 ♂ (holotype), 27th March, 1931, 1 ♂ (paratype), 20th July, 1930, Tshinkolobwe (*J. Romieux*).

May be placed near to *Dasychira ænotata* Tams.

Dasychira aphanes, sp. n. (Pl. IX. fig. 7.)

♂.—Palpus tawny-olive, on the outer side darker. Antennal shaft pinkish buff, irrorated with sepia, the pectinations snuff-brown. Head and thorax sepia mixed with pinkish buff. Abdomen, pectus, and venter pinkish buff, with fuscous-black dorsal tufts on the basal segments of the abdomen. Legs pinkish buff mixed with tawny-olive and sepia. Fore wing pinkish buff and Saccardo's-umber, irrorated over the whole wing with sepia ; a sepia antemedial fascia, slightly bowed, concavity basad, from costa to lower margin of cell, thence inwardly oblique to a point above the anal vein, thence outwardly oblique to the inner margin; discocellulars narrowly edged with sepia; postmedial fascia crenate, concavities terminad, points on the veins, running from the costa at two-thirds, curving round the distal side of the discocellulars to vein *Cu*2, thence outwardly oblique to the inner margin at two-thirds; a sepia subterminal fascia, edged distally with pinkish buff, the portion between vein *Cu*2 and the inner margin being rather prominent and running slightly oblique outwardly; a sepia preterminal fascia, broken at the veins; fringe pinkish buff, sepia interneurally. Hind wing pinkish buff, towards the termen sparsely irrorated with tawny-olive; fringe pinkish buff. Underside of fore wing pinkish buff; a faint streak of tawny-olive on the discocellulars and a postmedial fascia, almost straight, running from the costa at three-fourths to vein *Cu*1; costal area shaded with tawny-olive, and sparse tawny-olive irroration towards the termen and in the apical area; fringe as on upper side. Underside of hind wing, and fringe, as on upper side.

Expanse, ♂♂, 42–43 mm.

1 ♂ (holotype), 22nd July, 1930, 1 ♂ (paratype), 21st November, 1930, Tshinkolobwe (*J. Romieux*).

Resembles *Dasychira extorta* Distant, but can be easily distinguished by the absence of regular crenations in the antemedial fascia of the fore wing and the absence of a spot on the discocellulars of the hind wing.

Dasychira rhabdogonia, sp. n. (Pl. IX. fig. 19.)

♂.—Palpus pinkish buff, on the outer side bistre. Antennal shaft tea-green, pectinations bistre. Head and thorax tea-green, streaked with fuscous-black. Abdomen pinkish buff mixed with fuscous-black, and with fuscous-black dorsal tufts on the basal segments. Pectus, venter, and legs pale pinkish buff to pinkish buff, banded on the fore leg with fuscous-black. Fore wing tea-green, irrorated evenly over the whole wing with fuscous-black; a fuscous-black subbasal fascia, outwardly oblique to the cell, thence inwardly oblique to the inner margin; a wavy fuscous-black antemedial fascia from the costa at one-third to the inner margin at one-third; discocellulars bordered prominently with fuscous-black; a fuscous-black postmedial fascia, crenate, points on the veins, concavities terminad, commencing at the costa above the discocellulars, skirting their distal side and curving in below them to vein *Cu*2, thence to the inner margin; a fuscous-black streak outwardly oblique from vein *Cu*2 to the anal angle, and another streak running between veins *R*5 and *M*1 from a point midway between postmedial and termen to the preterminal fascia; the preterminal fascia is fuscous-black, interrupted at the veins; fringe pinkish buff, fuscous-black interneurally. Hind wing and fringe pale pinkish buff, shaded lightly with bistre, especially in the subterminal area, and with a line of bistre along the termen. Underside of fore wing pale pinkish buff, irrorated with bistre in and above the cell; discocellulars bordered faintly with bistre; an almost straight postmedial fascia from the costa at three-fourths to vein *Cu*2; fringe pale pinkish buff, tipped with bistre interneurally. Underside of hind wing and fringe pale pinkish buff, with a spot of bistre on the discocellulars and slight bistre shading along the costa and termen.

♀.—Resembles the ♂, but with the upper side of the hind wing darker.

Expanse, ♂♂ 25–32 mm., ♀ 38 mm.

1 ♂ (holotype), 16th October, 1931, 1 ♀ (allotype), 16th January, 1931, and 4 ♂♂ (paratypes), August, October, and December 1930, and January 1931, Tshinkolobwe (*J. Romieux*).

The rather prominent fuscous-black streak in the anal angle of the fore wing easily distinguishes this species.

Homochira pœcilosticta, sp. n. (Pl. IX. fig. 16.)

♂.—Resembling *Homochira rendalli* Distant, and possibly only a subspecies. The present insect is smaller than *H. rendalli*, and has a lighter aspect, due to the ground-colour of the fore wing and fringe being pale pinkish buff to white, giving a chequered appearance. In a large series of *H. rendalli* the variation in marking is considerable, but the mark on the discocellulars appears always to be oblong and its centre coloured similarly to the background, whereas in the present species the mark is rounded, with a centre of ochraceous-tawny.

Expanse, ♂♂, 28–30 mm.

1 ♂ (holotype) and 1 ♂ (paratype), December 1909 and 1900, Makulane, south of Lorenço Marques, Mozambique (*G. E. Audeoud*).

Aclonophlebia psolozona, sp. n. (Pl. IX. fig. 9.)

♂.—Antenna pale yellow-orange, with a patch of fuscous-black at the base of the shaft on the inner side. Palpus and head orange-buff, the vertex lightly marked with fuscous-black. Thorax, abdomen, and legs pale yellow-orange to orange-buff, with an admixture of fuscous-black on the patagium and tegula. Fore wing and fringe pale yellow-orange; at the base of the wing three sinuous fuscous-black fasciæ, separated from each other by narrow lines of the ground-colour; a broad fuscous-black postmedial fascia running from the costa at two-thirds to the inner margin at two-thirds, and with a faint line of the ground-colour running through its centre from costa to inner margin, the fascia having a projection towards the base at the discocellulars, and a projection towards the termen at vein *M*3 and again between vein *Cu*2 and the anal vein. Hind wing, underside of both wings, and fringes pale yellow-orange, the pattern of the fore wing lightly reproduced on the underside.

Expanse, ♂♂, 28–29 mm.

1 ♂ (holotype) and 1 ♂ (paratype), Tshinkolobwe, 24th January, 1931 (*J. Romieux*).

This handsome species is related to *Aclonophlebia dracontea* Romieux. It may be found necessary to place it in a new genus, but I should prefer to see an example of the ♀ before making a decision.

Aclonophlebia romieuxi, sp. n. (Pl. IX. fig. 13.)

♂.—Palpus mummy-brown. Antennal shaft fuscous-black, pectinations tawny-olive, darker at the base. Head and thorax mummy-brown, with a narrow collar of orange-buff at their junction and a few hair-scales of orange-buff in the patagium. Abdomen orange-buff, with a series of fuscous-black spots dorsally; anal tuft fuscous. Pectus, abdomen, and legs fuscous to fuscous-black. Fore wing benzo-brown, all the veins darker than the ground-colour; a small patch of orange-buff at the base of the wing and some fuscous-black markings subbasally; a rather prominent fuscous-black antemedial fascia running almost straight from the costa at one-third to the inner margin at one-third, but outwardly oblique from the anal vein to the margin ; a fuscous-black line on the discocellulars, extending upwards to the costa ; a rather faint postmedial fascia, composed of a double line of fuscous-black, crenate, points on the veins, concavities terminad ; fringe benzo-brown. Hind wing and fringe, above and beneath, white, very lightly marked along the distal half of the costa with benzo-brown. Underside of fore wing, and fringe, benzo-brown, with traces of the markings of the upperside.

Expanse, ♂♂, 30–33 mm.

1 ♂ (holotype) and 2 ♂♂ (paratypes), Tshinkolobwe, 15th-23rd February, 1931 (*J. Romieux*).

Aclonophlebia xuthosticta, sp. n (Pl. IX figs. 17 & 18.)

♂.—Palpus sepia tipped with orange-buff. Antenna sepia, mixed on the shaft with white. Head pinkish buff. Thorax pinkish buff, darker posteriorly, with a narrow collar of orange-buff between head and thorax. Abdomen above and beneath orange-buff, anal tuft Saccardo's-umber. Pectus and legs pinkish buff, mixed on the legs with sepia and white. Fore wing whitish, sparsely irrorated with Saccardo's-umber, giving a greyish appearance ; a subbasal fascia of sepia ; a sepia antemedial fascia, almost straight ; a sepia postmedial fascia, crenate, points on the veins, concavities terminad ; the space between antemedial and postmedial fasciæ filled in with Saccardo's-umber, forming a prominent central band across the wing, which varies considerably in width in different specimens ; a spot of orange-buff on the centre of the discocellulars, in some specimens produced as a line along the discocellulars ; fringe whitish, between the vein-ends Saccardo's-umber. Hind wing and fringe pale pinkish buff, the inner marginal area tinged with pale yellow-orange. Underside of both wings, and fringes, as on upperside, but with the colours less strongly marked.

♀.—Differs considerably from the ♂ in appearance, with the ground-colour of the fore wing drab and the spot on the discocellulars peach-red. The distal half of the hind wing suffused with Saccardo's-umber.

Expanse, ♂♂ 29–32 mm., ♀ 48 mm.

1 ♂ (holotype), 16th October, 1931, 1 ♀ (allotype), 16th October, 1930, 7 ♂♂ (paratypes), October 1930,

February, October (4) and November 1931; all Tshinkolobwe; 1 ♂ (paratype), 19th April, 1929, Tshituru, all taken by *J. Romieux*. Also, in the British Museum Collection, 2 ♂♂, October 1917, Solwezi. N.W. Rhodesia (*H. C. Dollman*).

Two of the Tshinkolobwe ♂♂ and 1 ♂ from Solwezi show no trace of Saccardo's-umber between the antemedial and postmedial fasciæ of the fore wing, and thus present a very different appearance.

Aclonophlebia minor, sp. n. (Pl. IX. fig. 8.)

♂.—Palpus cinnamon-buff. Antennal shaft clove-brown, pectinations pinkish buff. Head and thorax cartridge-buff, with some light orange-yellow hair-scales at the base of the antenna. Abdomen pale yellow-orange, anal tuft cartridge-buff. Pectus, venter, and legs cinnamon-buff to pale pinkish buff, mixed on fore leg with snuff-brown. Fore wing pale pinkish buff; a patch of clove-brown at the base of the costa; two prominent patches of clove-brown on the costa, antemedially and postmedially, forming the starting-points of two crenate fasciæ of the same colour, which cross the wing and reach the inner margin at two-fifths and two-thirds respectively; discocellulars unmarked; a series of clove-brown subterminal spots on the veins, with a patch of the same colour between vein *Cu*2 and the inner margin; a series of clove-brown terminal interneural spots, extending to the fringe, which is otherwise pale pinkish buff. Hind wing and fringe pale pinkish buff, with a small patch of clove-brown near the tornus. Underside of fore and hind wing as on upper side, but with the clove-brown on the costa of the fore wing extending from the base to the postmedial area, the other markings less prominent than on the upper side.

Expanse, ♂♂, 22–23 mm.

1 ♂ (holotype), 12th October, 1931, 3 ♂♂ (paratypes), January, February, and October 1931, Tshinkolobwe (*J. Romieux*).

This is the smallest member of the genus yet described. It somewhat resembles the variety of *Aclonophlebia xuthosticta* Collenette which is mentioned in the last paragraph of the above description, but has no coloured spot on the discocellulars of the fore wing.

EXPLANATION OF PLATE IX.

Fig. 1. *Marblepsis ochrobasis*, sp. n., type ♂.
Fig. 2. *Porthesaroa maculata*, sp. n., type ♂.
Fig. 3. *Dasychira katanga*, sp. n., type ♂.
Fig. 4. *Aroa interrogationis*, sp. n., type ♂.
Fig. 5. *Dasychira dasynota*, sp. n., type ♂.
Fig. 6. *Lælia pyrrhothrix*, sp. n., type ♂.
Fig. 7. *Dasychira aphanes*, sp. n., type ♂.
Fig. 8. *Aclonophlebia minor*, sp. n., type ♂.
Fig. 9. *Aclonophlebia psolozona*, sp. n., type ♂.
Fig. 10. *Euproctis stenoptila*, sp. n., type ♂.
Fig. 11. *Euproctis audeoudi*, sp. n., type ♂.
Fig. 12. *Dasychira chlororhina*, sp. n., type ♂.
Fig. 13. *Aclonophlebia romieuxi*, sp. n., type ♂.
Fig. 14. *Euproctis panda*, sp. n., type ♂.
Fig. 15. *Dasychira melarhina*, sp. n., type ♂.
Fig. 16. *Homochira pœcilosticta*, sp. n., type ♂.
Fig. 17. *Aclonophlebia xuthosticta*, sp. n., type ♂.
Fig. 18. *Aclonophlebia xuthosticta*, sp. n., allotype ♀.
Fig. 19. *Dasychira rhabdogonia*, sp. n., type ♂.

XXIII.—*Descriptions and Records of Bees.*—CLXVII.

By T. D. A. Cockerell, University of Colorado.

Megachile khamana, sp. n.

Male.—Length about 15·5 mm., width of abdomen 5.

Black, including mandibles and antennæ, but tegulæ clear ferruginous, the stout front femora and tibiæ bright ferruginous, the expanded front tarsi cream-colour; middle tibiæ red at extreme end, the middle and hind legs otherwise black except that the second to fourth joints of hind tarsi are somewhat brownish and the claws are basally red. The dense hair covering face and front is cream-colour, as is that on top of head, but on the broad cheeks (which are sharply carinate behind) it is white; on thorax above the hair is short and pale red, at sides and on metathorax it is long and white; it is white on legs, sparse and pale reddish on outer side of front tibiæ; on first abdominal tergite it is pale red in middle and pure white at sides; there are clear white hair-bands on apices of tergites 2 to 4 and on bases of 3 to 5, giving the effect of three pairs of bands; there is a narrow white band on apex of fifth and a broad one at base of sixth. Wings hyaline, conspicuously brownish apically; basal nervure meeting nervulus; second cubital cell relatively short. Mandibles bidentate and with a strong basal tooth below. Front basitarsi very broad, with a very long white fringe, in which pale red hairs are intermixed; middle tarsi with a very long white fringe; hind basitarsi with a comparatively short white fringe in front; hind basitarsi large, parallel-sided, with a terminal spine; joints 2 to 4 of hind tarsi small, bead-like, fifth very long. Mesothorax and scutellum dull, very densely and minutely punctured.

Bechuanaland: Palapye Road, March 6, 1934 (*J. Ogilvie*).

Named after Chief Khama. This is in every way closely allied to *M. konowiana* Friese, but is readily separated by the following characters:—Anterior basitarsi much broader, without the very long anterior fringe; flagellum shorter, a little broadened at end; middle tibiæ without a long white fringe behind; hind basitarsi entirely black; joints 2 to 5 of hind tarsi not broadened; abdominal hair-bands pure white; the large apical lobe (on sixth tergite) rounded and not notched; basal nervure meeting nervulus.

Megachile serraticauda, sp. n.

Male.—Length about 12 mm., width of abdomen 4·5.

Black, including mandibles and antennæ, but the small tegulæ pellucid pale testaceous; head and thorax with abundant rather long pure white hair, a little brown hair on vertex; mandibles bidentate, with a swelling at base below, largely concealed by white hair; margin of clypeus simple; eyes light brown; vertex dull; mesothorax and scutellum dull, the punctures hardly visible, but the mesothorax is a little shining along the middle line. Wings hyaline, the outer margin broadly dusky; stigma red, with a brown margin; nervures brown; basal nervure falling far short of nervulus. Anterior coxæ spined; legs black, with the front and middle tibiæ red at apex; front tarsi pale reddish, the basitarsi expanded, mainly pale yellow, with a black spot near end on inner side; the white fringe behind is about as long as width of tarsus; middle and hind tarsi red. Abdomen with rather dull long white hair on first tergite and second except at base; second and third tergites with rather broad pure white hair-bands and some white hair near base of third; fifth tergite with rather thin red hair and an apical white band; sixth above densely covered with dull yellow hair, except the apical margin of the very broadly rounded keel, which is multidentate, not notched in middle; no teeth or spines on under side of apex; venter with white hair-bands.

Cape Province: five taken by J. and L. Ogilvie, three dated June 30 and two dated May 1. They were labelled at the British Museum "S.W. Africa, Cape Town, Beaufort West." On May 1 the Ogilvies were at Beaufort West; by June 30 they had left Africa.

The sixth tergite is like that of *M. reicherti* Brauns, but that has the margins of fourth and fifth tergites with fox-red hair, and other differences. Another similar species is *M. ameliæ* Ckll., but that has the legs quite different. *M. neavei* Vachal differs by the red anterior femora and other characters. Looking at the insect from above the red hair on the fifth tergite of *M. serraticauda* is not evident, and sometimes the hair is only obscurely red.

Megachile serraticauda damarica, subsp. n.

♂.—Structurally like *M. serraticauda*, but considerably more slender (width of the parallel-sided abdomen about 3·4 mm.), with the hair of head, thorax, and abdomen all pure white; the flagellum is dusky red beneath; the wings are slightly reddish, and not darkened apically; the front basitarsi are clear pale yellow, but the apex of tibia is red; the anterior knees are red.

S.W. Africa: Windhoek, Dec. 14, 1933 (*J. Ogilvie*).

Megachile (*Creightonella*) *sanctissima*, sp. n.

♂.—Length about 10·5 mm., anterior wing 7·3.

Black, including mandibles, antennæ, tegulæ, and legs, except that the claws are red with the end black, the keel of sixth tergite is broadly dark red apically, the seventh tergite is red, and also the apical middle of fifth sternite; hair of face, cheeks, sides of thorax, and metathorax long and pure white; vertex with thin black hair; mesothorax with black hair on disc, white at sides; scutellum with much long black hair; eyes reddish grey, ocelli pale red; mandibles with a large tooth below; mesothorax and scutellum dull, densely and minutely punctured. Wings hyaline, with the broad apical margin brown; nervures dark, basal nervure falling short of nervulus. Front coxæ spined; front tarsi simple, with white hair on outer side and red on inner; the other tarsi also have red hair on inner side. Abdomen glistening, with pure white hair-bands, on first two tergites very broad at sides and failing in middle, on third and fourth entire; fifth with an entire marginal white band, before which is long red hair; sixth quadrate, very strongly keeled in middle, covered with pale orange tomentum except basal middle and broad apical margin of keel, which is coarsely irregularly serrate; seventh tergite sharply pointed; fourth sternite deeply emarginate, without spines; venter with white hair-bands.

S.W. Africa: Otavi, Dec. 25, 1933 (*L. Ogilvie*).

A neat little species, by the colour of the hair on fifth tergite resembling the much larger and otherwise different *M. heptadonta* Ckll. It also may be compared with *M. polyacantha* Ckll., which has the hair of thorax above dark brown.

Megachile (*Eumegachile*) *chrysorrhœa* var. *perimelæna*, nov.

♀ (type).—Hair of head, thorax, and base of abdomen all black, except that there is short silvery-white hair on under side of thorax.

♂.—Thorax with black hair, face with white; a little pale hair at extreme sides of first tergite.

Cape Province: Upington (*J. Ogilvie*). Female, Feb. 21, 1934; male, Dec. 7, 1933.

Megachile (*Eumegachile*) *perniciosa* Friese.

Males from Mafeking, Feb. 27 (*J. Ogilvie*), and Okahandja, Jan. 24 (*L. Ogilvie*).

They have the abdomen conspicuously narrow and elongate. The Mafeking one has black hair on thorax above, tubercles, and metathorax, but white hair on mesopleura. The Okahandja one differs by the paler, strongly reddened wings, suggesting that Friese was right in referring *M. pallipennis* Friese, with orange wings, to *M. perniciosa* as a variety or race.

Megachile damaraensis Friese.

S.W. Africa: apparently common, Otavi, 2 ♀, 10 ♂ (*J. Ogilvie, L. Ogilvie*); Otavifontein, 1 ♂ (*J. O.*); Otjiwarongo, 1 ♀ (*J. O.*). Also females from Palapye Road and Mafeking (*L. O.*, *J. O.*).

A male collected by Turner at Okahandja, received from the British Museum as *M. basalis* Smith, is almost exactly like the males of *M. damaraensis*, but somewhat larger, and the inner pair of teeth at end of abdomen below are entirely black and sharply pointed, whereas in *M. damaraensis* they are light red, shorter, and more obtuse.

Megachile capiticola, sp. n.

♂.—Length about 12 mm., anterior wing 7·6.

Black, rather robust, parallel-sided; mandibles and antennæ entirely black; head and thorax with abundant long hair, on cheeks pure white, on face white, with a yellowish tint at sides, on vertex tinged with reddish brown, on thorax above suffused with pale greyish yellow, but with no black hairs; on pleura and metathorax the hair is very long and white; eyes grey; clypeus dull, partly bare above, but overlapped by two long tufts of hair; vertex densely punctured, glistening between the punctures; mesothorax and scutellum dull, the punctures extremely small; tegulæ pale reddish. Wings brownish hyaline; basal nervure falling a little short of nervulus; second cubital cell long, receiving recurrent nervures equally distant from base and apex. Legs mainly black, with white hair, but front femora red, with a dark longitudinal band, lower edge sharply keeled; front tibiæ broadly red on under side; front tarsi moderately thickened, creamy-white, with the basitarsus strongly suffused with blackish except apically, and the long apical joint red; there is a dense white fringe, about as broad as the tarsus; front coxæ with spines; middle tarsi apically red and the basitarsi with a very long white fringe behind. Abdomen glistening, tergites 1 to 4 with rather long white hair, forming apical bands, but before the bands on second and third is a certain amount of pale reddish hair, not conspicuous, while there is long black hair subapically on fourth and fifth; the fifth tergite has a slender white apical hair-band; sixth covered with dense white hair above, except at extreme sides, and a little space in apical middle; the transverse keel of sixth has a deep rounded median emargination, bordered on each side by a straight stout spine, and the margin laterad of the spines is variably denticulate; no lateral spines, and no spine at end of venter.

Cape Province: Lion's Head, Cape Town, Oct. 29, 1933 (*J. Ogilvie*).

Related to *M. digiticauda* Ckll., but larger and more robust, with the long spines on sixth tergite straight and much more slender, and a strong sharp keel on under side of front femora.

Megachile subcordata, sp. n.

♀.—Length 10 mm., width of abdomen 4.

Appearance exactly like *M. cordata* Smith, with which I at first thought it identical, but it is easily separated by the parallel-sided hind basitarsi and the abundant but thin erect red hair on abdomen above as far as fifth tergite, all these tergites having continuous whitish hair-bands; the sixth tergite has no red hair, but white tomentum (not divided into two spots), with a few short black hairs. The tegulæ are light rufo-testaceous, exactly as in *M. cordata*; the wings are similar, but somewhat darker, with stronger nervures.

Other characters are: mandibles and antennæ black, the mandibles slightly reddened apically, the long cutting margin crenulate, hardly dentate; hair of face pale fulvescent or whitish, not pure white; vertex with brownish hair; mesothorax and scutellum entirely dull; hair of thorax above pale reddish, with no dark hairs, contrasting with the white of the metathorax; sides of thorax with dull white hair; legs with white hair, very bright red on inner side of hind tarsi; ventral scopa white at base, but on three sternites very bright red, and entirely black on the last. The tarsi have the apical joint red.

Orange Free State: North Bank Halt, Norval's Pont, April 16, 1934, two (*J. Ogilvie*).

Closely related to *M. hypopyrrha* Ckll., from the Katanga region, but differing by the lack of dark hair on thorax above, the light hair on sixth tergite, the first recurrent nervure much more remote from base of second cubital cell than second from apex, and ventral scopa bright red on three sternites. They agree in the clypeus, with a smooth median band. There is also a close resemblance to the tropical *M. ekuivella* Ckll. By the erect red hair on abdomen it resembles *M. flammicauda* Ckll., but that has abundant black hair (and no red) on the fifth tergite.

Megachile patellimana Spinola.

Many years ago Friese recorded this from Grootfontein, S.W. Africa. It is a well-known species, originally described from Egypt. Its occurrence in S.W. Africa seemed so improbable that I suspected some mistake, but I now have to apologize to Friese for my doubts, for Mr. and Mrs. Ogilvie collected three perfectly characteristic males at Otavifontein. This is less than fifty miles from Friese's locality.

Megachile bangana Cockerell.

Belgian Congo: Kabinda and Luputa (*J. Bequaert*). Described from Liberia.

At Kabinda Dr. Bequaert also collected *M. rufipes* Fab., *M. lobicauda* Ckll., *M. triangulifera* Fr., and *M. ancillula* Vach., the last at *Vernonia* flowers. At Luputa he also obtained *M. trichora* Vach., *M. clypearis* Fr. (less robust than usual), *M. bituberculata* Rits., *M. ianthoptera* Sm., *M. crocuta* Schlett., *M. pyrrhothorax* Schlett., *M. adeloptera* Schlett., and *M. callichlora* Ckll.

Megachile cradockensis Friese.

Bechuanaland: Palapye Road, March 4, one male (*J. Ogilvie*).

At this locality the Ogilvies also collected *M. konowiana* Fr., *M. cyanescens* Fr., *M. aurifera* Ckll., and *M. basalis* Sm.

Megachile konowiana Friese.

Cape Province: Mafeking, male, Feb. 27 (*J. Ogilvie*).

Here the Ogilvies also collected *M. fimbriata* Sm.

Megachile clarescens (Cockerell).

Cape Province: Bot River, November, a small male (*J. Ogilvie*).

Here the Ogilvies also collected a variety of female *M. venusta* Sm., with the hair on apical sternite all black.

Megachile nasalis Smith.

Bechuanaland: Lobatsi; and also at Otavi, S.W. Africa (*L. Ogilvie*).

At Lobatsi the Ogilvies also collected *M. venusta* Sm.

Megachile microxanthops Cockerell.

Cape Province : Nelspoort (*J. Ogilvie*).

Here the Ogilvies also collected *M. gratiosa* Gerst. and *M. venusta* Sm.

Megachile cyanescens Friese.

The Ogilvies collected this in S.W. Africa, at Otavi, Otavifontein, and Okahandja.

Osmia infrapicta (Cockerell).

Lion's Head, Cape Town, and Kirstenbosch (*J. Ogilvie*).

Osmia karooensis Brauns.

Norval's Pont, April 16, 1934, female (*J. Ogilvie*).

Brauns says it flies in August and September, so it is apparently double-brooded.

Nomia tetrazonata Cockerell.

Nebraska : Harrison, July 2, 1936 (*John Player*). Described from Arizona.

Holcopasites hæmaturus Cockerell & Hicks.

Nebraska : Harrison, July 2 (*John Player*). Described from Colorado.

XXIV.—*On some new or interesting Asiatic Blattodea.* By G. Bey-Bienko, D.Sc., Institute of Plant Protection, Leningrad.

The present paper contains descriptions of four new species of Asiatic Blattodea and notes on some previously known species.

Ectobius jarringi (Hanitsch).

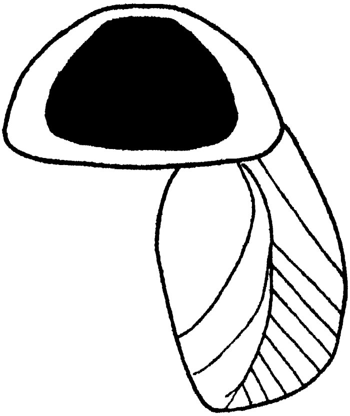
1937. *Hololampra jarringi* Hanitsch, Opusc. Ent. i. (4) p. 102 (♀; Tragbal, Kashmir).

This species was referred by Dr. Hanitsch to the genus *Hololampra* (=*Phyllodromica* Fieb.), but an examination of the type-specimen, kindly sent to me for a study by Dr. N. A Kemner and Dr. K. Ander, University of Lund, Sweden, has shown that by the structure of elytra (presence of distinct anal sulcus) this species must be placed in the genus *Ectobius*. The species somewhat resembles *E. kirgisius* B.-Bienko, from the Alexandrovsky range. The armament of the anterior femora (type B, and not C as described by Hanitsch) and the structure of the tarsal claws are typical for the genus *Ectobius*.

Ectobius indicus, sp. n. (Fig. 1.)

♀.—Of medium size. Vertex with interspace between eyes moderately broad, distinctly broadened downwards; apical joint of maxillary palpi moderately broadened, a little less than 1·5 times as long as the third joint and practically twice as long as the fourth joint. Pronotum semicircular, strongly transverse, hind margin quite straight. Elytra abbreviate, reaching the third abdominal tergite, distinctly longer than pronotum, apex transversely tuncate; costal margin convex, externo-posterior angle broadly rounded, interno-posterior angle more pronounced, narrowly rounded, practically straight; *Sc* distinctly extending beyond the middle of costal margin; costal veins (oblique sectors of *R*) 8–10 in number; anal sulcus well developed. Abdomen and cerci as usual in the genus. Anterior lower margin of anterior femora armed with two median spines, followed in apical half of femora with a row of small piliform spinulæ (type B), apex of femora with two unequal spines; tarsal claws distinctly unequal.

Fig. 1.



Ectobius indicus, sp. n., ♀ (type).

General coloration brownish black. Face, vertex, and maxillary palpi uniformly dark blackish brown; pronotum brownish black, bordered with whitish. Elytra of a light ground-colour, with numerous intervenational dark spots. Abdomen brownish black above, lateral part of the third to sixth tergites with a yellow elongated spot, lateral margins with very narrow yellow border, median part of the second to sixth tergites with two indistinct yellowish-brown spots, seventh tergite for the greater part yellow, with brownish-black spot on the middle of each lateral half, eighth tergite completely yellow. Lower surface of abdomen blackish brown, with yellow rounded lateral spots on the second to seventh sternites and with two brownish-yellow median stripes on the fourth to sixth sternites; seventh sternite almost completely blackish brown. Coxæ and femora dirty brown; tibiæ yellow, with darkened basal and apical part: upper surface with dark spots placed just at the base of tibial spines.

Length of body, ♀, 7·5; pronotum 1·9; elytra 2·9; greatest width of pronotum 3·5 mm.

Ootheca smooth, without longitudinal keels.

N.W. Ind(ia), 1 ♀ (no exact data). Type in the British Museum.

This interesting species (kindly sent to me for study by Dr. B. P. Uvarov) may be easily distinguished by the peculiar coloration of its pronotum. In the shape of elytra it resembles *E. jarringi* Hanitsch from Kashmir.

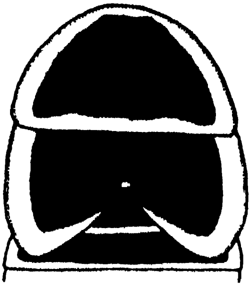
This is the first Indian representative of the genus *Ectobius*.

Phyllodromica (*Arbiblatta*) *syriaca*, sp. n. (Fig. 2.)

♂.—Size small for the genus. Maxillary palpi with fifth joint moderately broadened in the basal half, equal in length to the third joint and slightly longer than the fourth. Pronotum strongly transverse, about twice as broad as long, semicircular; hind margin quite straight; latero-posterior angles distinct, slightly rounded. Elytra reaching the second abdominal tergite, scarcely longer than pronotum, roundly triangular; costal margin moderately convex, forming with posterior margin practically straight angle; sutural margin convex, forming with hind margin an obtuse, broadly rounded angle; inner margins not touching each other, exposing a large scutellum; venation indistinct. Sixth abdominal tergite with hind margin moderately concave in the middle and slightly thickened; hind margin of the seventh tergite straight, median part of this tergite slightly inflated; eighth tergite very short; supra-anal plate with hind margin roundly triangular. Cerci short, about three times as long as broad. Subgenital plate moderately asymmetrical, subtriangular; styliform process very small, almost tuberculiform. Anterior lower margin of anterior femora armed with a row of minute piliform spines and two large distal spines (type C).

General coloration piceous black, shining.

Fig. 2.



Phyllodromica (Arbiblatta) syriaca, sp. n., ♂ (paratype).

Head brownish, shining; vertex with upper part of the interspace between eyes pale; maxillary palpi dirty yellow. Pronotum piceous black, bordered with whitish. Elytra piceous black; costal margin with a broad whitish border; hind margin with less broad border. Hind margins of meso- and metanotum with a narrow whitish border. Second to fifth abdominal tergites piceous black; lateral and hind margins bordered with whitish; apical tergites reddish yellow; cerci brownish yellow, basal and apical part darkened; lower surface of abdomen brownish, lateral sides bordered with whitish. Legs pale yellow, upper margin of anterior femora and basal part of all tarsi brownish.

Length of body, ♂ 5·2; pronotum 1·4–1·5; elytra 1·8–1·9 mm.

Jebellié, Syria, 2 ♂♂ (*Dr. Leuthner*).

Type (no. 15.679 of the Brunner-Wattenwyl collection) in the Vienna Museum; paratype in the Zoological Institute, Leningrad.

This peculiar species, placed at my disposal for study by Dr. M. Beier and Prof. Dr. R. Ebner, Vienna, is well characterized by its coloration, structure of elytra, and anterior femora. It belongs to the subgenus *Arbiblatta* Chop. (1936), characterized by the absence of distinct venation on elytra of ♂. The subgenus *Arbiblatta* was described as an independent genus (type *Ph. larrinuæ* Bol.), but there are no features separating the female sex of *Arbiblatta* from the same sex of *Phyllodromica*, and I consider *Arbiblatta* only as a subgenus of *Phyllodromica*.

Genus SHELFORDELLA Adel.

Adelung has based this genus on a single diagnostic feature, viz., on a very pronounced sexual dimorphism of the genotype. Therefore it was impossible to determine the genus on a single sex. A careful study of the genotype and representatives of the related Palæarctic genera shows, however, that the genus *Shelfordella* is well characterized also by the structure of tarsi and by venation of elytra, as shown in the following key to the Palæarctic genera of the subfamily Blattinæ:—

1 (4). Tarsi with distinct arolia between claws. Elytra and wings in both sexes similar in size [*]. First abdominal tergite of ♂ often specialized (with a tuft of hairs).

2 (3). Elytra and wings (at least in ♂) fully developed, reaching to, or extending beyond, apex of abdomen; elytra coriaceous, venation distinct, costoradial field with distinctly approximated oblique branches of *R* ...... 1. *Periplaneta* Burm. [(genotype: *P. americana* L.).

3 (2). Elytra and wings moderately abbreviated, not reaching apex of abdomen; elytra more chitinized, subcorneous, oblique branches of *R* conspicuously spaced. (First abdominal tergite in ♂ specialized.) .... 2. *Hebardina* nom. nov.[†] [(genotype: *H. concinna* Haan).

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[*] Except the female of *Periplaneta japonica* Karny, in which elytra are abbreviate, distinctly shorter than in the male sex.

[†] This name is proposed for *Blattina* Hebard (1929), *nec* Germar (1842).

4 (1). Arolia rudimentary, practically absent. Sexes strongly dissimilar; elytra and wings in ♀ abbreviate, not or scarcely longer than pronotum. First abdominal tergite in ♂ unspecialized.

5 (6). Elytra and wings in ♂ fully developed, greatly extending beyond apex of abdomen. Supra-anal plate of ♂ subchitinous, hyaline, distal portion strongly notched. Elytra in ♀ with anal sulcus strongly arcuate, anal field broadly ovate. .... 3. *Shelfordella* Adel. [(genotype: *Sh. tartara* Sauss.).

6 (5). Elytra and wings in ♂ abbreviate, not reaching the apex of abdomen, wings shorter than elytra. Supra-anal plate in ♂ transverse, chitinous, neither hyaline, nor notched. Elytra in ♀ with anal sulcus feebly arcuate, anal field narrow, pointed at apex.. 4. *Blatta* L. (genotype: *B. orientalis* L.).

Shelfordella tartara (Sauss.).

Arabia: Riyadh, 20. x. 1934, 1 ♂; Mecca, 17. iii. 1934, 1 ♂ (*H. St. J. B. Philby*). British Museum collection.

Both specimens are quite typical and do not differ from the Central Asiatic representatives of the species.

A widely distributed Eremian species, but not recorded previously from Arabia.

Shelfordella arabica, sp. n. (Fig. 3.)

♀.—Superficially very like ♀ of *Blatta orientalis* L., but closely allied to *Sh. gussakovskyi* B.-Bienko (unpublished) from S. Tadzhikistan. Body relatively broad. Head with scattered sparse impressed points on the face and vertex; interocular space on vertex scarcely longer than the length of an eye. Pronotum as in ♀ of *Blatta orientalis* and ♀ of *Shelfordella tartara*, about 1·4 times as broad as long; anterior margin straight; lateral margins moderately convex, divergent backwards; hind margin slightly convex, practically straight; latero-posterior angles rounded. Elytra abbreviate, not lateral, equal in length to pronotum and reaching the first abdominal tergite; costal margin practically straight; apex of elytra transversely truncate, externo-posterior angle of about 90°; sutural margin moderately convex, forming with hind margin a very distinct, practically straight angle; *R* slightly incurved, parallel to costal margin;

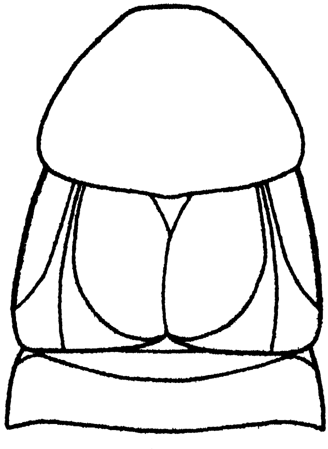
anal sulcus strongly arcuate; anal area about 1·4 times as long as broad. Abdomen with eight visible tergites, relatively broad; penultimate tergite broadly triangular, its hind margin with well-developed median obtuse-angular excision; last tergite (supra-anal plate) triangular, tectiform, with triangular excision on the apex. Arolia between tarsal claws practically absent.

Coloration uniformly piceous black, shining; elytra piceous brown.

Length of body 24·5–27; pronotum 6–7; elytra 6·3 mm.

Arabia: Mecca, 4000–5000 feet, 8. iii. 1934, 1 ♀; Taif, 4000–5000 feet, 18. v. 1934, 1 ♀ (type) (*H. St. J. B. Philby*).

Fig. 3.



Shelfordella arabica, sp. n., ♀ (type).

Type in the British Museum, London; paratype in the Zoological Institute, Leningrad.

This species (sent to me for study by Dr. B. P. Uvarov) is characterized by the same structure of elytra as in ♀ of *Sh. gussakovskyi* m., and differs from it in more robust body, shape of elytra, and structure of the seventh abdominal tergite.

It is interesting to note that *Sh. arabica* shows a great similarity with the South African *Blatta æronigra* Rehn (1922), but the last-named species is characterized by somewhat aberrant features, and its exact systematical position is not quite clear.

Genus CRYPTOCERCUS Scudd.

1862. *Cryptocercus* Scudder, Boston Journ. Nat. Hist. vii. p. 419.

Genotype: *Cryptocercus punctulatus* Scudd. from the United States of America.

The genus *Cryptocercus* was known for a long time from a single species, viz., *Cr. punctulatus* Scudd. In 1935 I described a second species from the Russian Far East, Manchuria, and N.W. China under the name *Cryptocercus relictus* ('Konowia,' xiv. p. 130, figs. 10–13); but a re-examination of the original series of this species has showed that specimens from N.W. China belong to an independent species, characterized by the most generalized features.

Cryptocercus primarius, sp. n.

1935. *Cryptocercus relictus* Bey-Bienko, 'Konowia,' xiv. p. 130 (partim).

♀.—Body larger than in *Cr. relictus* B.-Bienko; very similar in appearance to the North American *Cr. punctulatus* Scudd. Sides of third to sixth abdominal tergites with very distinct rugosities and strong puncturation, intensified backwards; seventh tergite with distinct transverse rugosities, apex narrowly rounded, angular; lateral parts of lower surface of abdomen with punctuation more dense than in *Cr. relictus*, slightly rugose. All femora with two apical spines on posterior lower margin; upper side of hind tibiæ with 11–12 spines, lower side with 6 spines. Other features as in *Cr. relictus*.

Length of body, ♀ 22·6–23·5; pronotum 6·2 mm.

Szechuan Prov., N.W. China: Lunanfu, Hodzihou, 2040 m., 1 ♀ (type), and Lunanfu, Tazaopin, 4270 m., 1 ♀ (*M. Berezovsky*). Type and the paratype in the Zoological Institute, Leningrad.

This is the most primitive representative of the genus *Cryptocercus*. It possesses mixed features, belonging to *Cr. relictus* on one hand (presence of genicular spines on median and hind femora) and to *Cr. punctulatus* on the other (armament of the posterior lower margin of the median and posterior femora and number of spines on hind tibiæ).

The three known species of this genus can be determined by the following key:—

1 (4). Body larger (22·6–29 mm.). Seventh abdominal tergite distinctly rugose, its lateral margins straight, apex

narrow, practically angular. Median and posterior femora armed with two apical spines on posterior lower margin. Hind tibiæ with 11-13 spines on upper and six spines on lower surface.

2 (3). Median and posterior femora with a small but distinct genicular spine. Seventh abdominal tergite with lateral margins less elevated, its surface with distinct transverse rugosities. (Szechuan Prov., N.W. China.) .... 1. *Cr. primarius*, sp. n.

3 (2). Median and posterior femora without genicular spines. Seventh abdominal tergite with lateral margins strongly elevated, cingulate, its surface thickly covered with minute tubercles. (From New York State to northern Georgia, Eastern U.S.A.; Washington State, Oregon, and N. California, Western U.S.A.) .... 2. *Cr. punctulatus* Scudd.

4 (1). Body smaller (17–20·8 mm.). Seventh abdominal tergite not rugose, with sparse punctures, its apex broadly rounded, not angulate. Median and posterior femora unarmed on posterior lower margin. Hind tibiæ with 9-10 spines on upper and 4–5 spines on lower surface. Median and posterior femora with genicular spine. (South Ussury region and E. Manchuria.) .... 3. *Cr. relictus* B.-Bienko.

XXV.—*Preliminary Note on the Life-history of* Cryptocotyle jejuna *Nicoll*, 1907 (*Trematoda*). By MIRIAM ROTHSCHILD.

IN 1907 and 1910 Lebour erroneously described a cercaria from *Littorina littorea* L. and *Peringia ulvæ* (Pennant, 1777) (=*Paludestrina stagnalis*) as "*Cercaria lophocerca* Filippi, 1859." It has since been discovered (Stunkard, 1930) that the species from *Littorina littorea* is the larval form of *Cryptocotyle lingua* (Creplin, 1852).

An examination of *Peringia ulvæ* obtained from various localities in England, Scotland, and Wales revealed no infection with the Cercaria of *Cryptocotyle lingua* or *Cercaria lophocerca* Fil., but at least seven related species were found, all pertaining to the Pleuro- and Parapleurolophocercous groups (Sewell, 1922). In several cases great difficulty was experienced in distinguishing between certain species of these cercariæ unless living material was available for comparison. It is therefore not surprising that thirty years ago Lebour described them under one specific name. The commonest of the Pleurolophocercous cercariæ from *Peringia ulvæ* proved to be the larval form of *Cryptocotyle jejuna* Nicoll, 1907. It occurred in one to thirty per cent. of the snails examined. It is easily distinguished from the closely related Cercaria of *C. lingua*, being considerably smaller in size, possessing only fourteen instead of eighteen penetration gland-cells, and its free-swimming life lasting a bare eight hours compared with the forty-two hours of the larger species.

I experimentally infected Gobies, both *Gobius minutus* L. and *Gobius ruthensparri* Euphras., with these cercariæ. They encysted in the fins and beneath the scales. After a period of fourteen days the cysts were fed to a laboratory-reared (Rothschild, 1936) black-headed gull (*Larus ridibundus* L.). The adult worm was recovered from the intestine four weeks later.

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XXVI.—*The Occurrence of* Athelges paguri (*Rathke*) *in the Branchial Chamber of* Eupagurus bernhardus. By J. G. CATTLEY, B.Sc, Department of Zoology, University College, Cardiff.

LAST December, when the Honours Class was dissecting *Eupagurus bernhardus*, one of the students asked me to identify an isopod parasite which he had found in the left branchial cavity of his specimen. The parasite had occupied the left branchial chamber, which, I was informed, was distinctly swollen and had caused the complete atrophy of the two anterior gill-filaments. The parasite had occupied a normal position in the chamber, *i. e.*, with its posterior end directed forwards. Unfortunately the *Eupagurus* had been so dissected as to be useless for preserving. The parasite proved to be a young female *Athelges paguri* (Rathke) with incubatory plates not yet fully developed, but only just overlapping in the median line. The right side from the median line was flattened on the dorsal surface owing to its having been pressed against the inner wall of the branchial chamber. The body was only slightly distorted and measured 6 mm. in length.

Athelges paguri is normally an abdominal parasite, so that it is of considerable interest to record it, for the first time, from the branchial cavity of its host. There is no other known case, so far as I am aware, of an abdominal parasite being found in the branchial chamber, but a somewhat similar case has been recorded of a branchial form being found on the abdomen of a crab. Bonnier doubtfully referred this species to *Orbione.* Chopra (1923, p. 447) says of this species: "Except for the Brachyurous host there does not seem to be any substantial reason why *O. incerta* should not be placed in the genus *Orbione.*" Bonnier (1900, p. 282) is of the opinion that it was found accidentally on the crab. Whatever the correct explanation, it is here shown that the reverse can occur. It is, of course, much easier for an abdominal parasite to find its way, in its earlier stages of attachment, into the branchial chamber from (?) the abdomen than for a branchial form to leave its usual position and *remain* attached to the abdomen.

The host came in a consignment from Plymouth, dated 19. xii. 36.

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THE ANNALS AND MAGAZINE OF NATURAL HISTORY.

[ELEVENTH SERIES.]

No. 3. MARCH 1938.

XXVII.—*Megachiline Bees of New Guinea.*

By L. EVELYN CHEESMAN, F.R.E.S.

THE following Megachiline bees form part of a collection of insects made by myself in New Guinea, together with material in the B.M. They belong to a Papuan species group which is probably a subgenus of *Megachile*, but until the males of all the species are known this cannot be decided. Outside New Guinea they are represented by one species in Queensland and one in the New Hebrides.

Megachile lateritia group.

Second segment of flagellum in both sexes short, much wider than long, length about half the third. Clypeus flat, with or without longitudinal keel, apical margin weakly undulate; supraclypeal area separated by a transverse carina, but not raised. Mesonotum or abdominal tergites, or both, covered in pile.

1. ***Megachile lateritia*** Sm. 1859, Journ. Linn. Soc. London (3) Suppl. p. 134. ♀ (Aru). Type in B.M.

Redescribed.

♀.—Black. Hair of head and thorax black, of undersides of tarsi dark brown; propodeon and first abdominal tergite with dense, cinnamon hair; remaining tergites covered with tawny pile. Scopa tawny-red. Wings brown, almost hyaline at the base.

Mandibles minutely granulate basally, with a few fine punctures, bidentate, apical tooth rather acute, second wide and short. Clypeus shining, densely, finely reticulate-punctate; no longitudinal carina, apical margin slightly produced medially and each side. Supraclypeal area indistinctly longitudinally carinate, with a strong, short carina between the antennæ. Hair of the face short, dense laterally and on the frons. Distance between hind ocellus and occiput almost twice that between ocellus and eye. Frons and vertex minutely reticulate-punctate, with scattered punctures. Cheeks striate-punctate, space between striæ equals width of a puncture. Mesonotum and scutellum very finely transversely striate punctate, bare.

Length 17 mm.

Aru Is., 1 ♀ (type). Collected by A. R. Wallace.

1. Subsp. *nidulator* Sm. 1865, *op. cit.* (8) p. 92, ♀ (Dory). Type in Hope Museum, Oxford.

♀.—Black. Hair of propodeon and first abdominal tergite white, pile of discs of second and third tergites black, except on apical margin of third. Wings dark brown.

Clypeus with strong, transverse carina, and short, strong longitudinal carina in basal half; supraclypeal area carinate, but not distinctly except for a short, strong carina between the antennæ.

Length 17 mm.

♂ as ♀, but with a tuft of white hair between the antennæ and thick white fringe at apical margin of clypeus. Red hair mixed with white at lateral angles of first abdominal tergite; seventh tergite covered with red tomentum except the deep fovea, apically very weakly emarginate.

Clypeus shining, regularly finely punctate. Mesonotum rather less densely punctate than in ♀ except laterally.

W. Dutch New Guinea, Dory, 1 ♀ (type), Oxford; S. Dutch New Guinea, Mimika R., 4 ♀♀, 1911 (*A. P. R. Wollaston*); N. Dutch New Guinea, Angi Lakes, 2 ♀♀, 1915 (*T. V. Sherrin*); Papua, Northern Territory, Oquali, 4500 ft., 1 ♀, vii. 1933; N.E. Dutch New Guinea, Mt. Nomo, 1 ♀, ii. 1936, Sabron, 1 ♂, v. 1936 (*L. E. Cheesman*).

2. Subsp. *albobasalis* Sm. 1879, Desc. New Sp. Hym. p. 65, ♀ (Murray Is.). Type in B.M.

Redescribed.

♀.—Black. Hair of first abdominal tergite white; of remaining tergites, undersides of tarsi and scopa, red. Hair of propodeon pale cinnamon, laterally brown; of first abdominal tergite, white. Wings dark brown.

Clypeus with no longitudinal carina, supraclypeal area weakly, indistinctly carinate, distinctly between antennæ.

Length 16 mm.

Torres Str. Is.: Murray Is., 1 ♀.

3. Subsp. *malayana* Cam. 1901, Proc. Zool. Soc. London, i. p. 245, ♂ (New Guinea). Type in B.M. =*albobasalis* Friese, 1908, Nova Guinea v. Zool. tab. xv. fig. 13.

♀.—Black, abdomen red. Hair on frons white. Vertex with white pile not extending on cheeks. Pile of basal third of first abdominal tergite black, of remaining tergites red; scopa red. Antennæ dark brown. Apical tooth of mandibles long. Clypeus with longitudinal shining area, margin with medial shining area.

Length 15 mm.

♂.—Dense fringe of hair at apical margin of clypeus and tufts between antennæ pale yellow; hair of frons and pile on vertex white.

Clypeus regularly, rather coarsely reticulate punctate. (Abdomen missing.)

New Guinea (Cam. Coll.), 1 ♂ (type), 1902; Mimika R., 1 ♀, 1911 (*A. P. R. Wollaston*).

Var. *auriceps* Meade-Waldo, 1915, Nov. Guinea Zool. p. 17; Ann & Mag. Nat. Hist. xiv. 1914, p. 456.

Hair on frons and vertex deep gold.

Length 18 mm.

Var. *lorentzi* Friese, 1914, Nov. Guinea, ix., Zool. p. 263.

Hair of pronotum black.

S. Dutch New Guinea: Utakwa R., 2 ♀♀, 1914 (*A. P. R. Wollaston*).

Megachile tertia D.T., 1896. =*M. senex* Sm., Journ. Linn. Soc. viii. 1863, p. 92 (*nec* 1853 and 1862), ♀ (New Guinea). Type in Hope Museum, Oxford.

♀.—Black. Hair of clypeus silvery, on frons and sides of face white, vertex covered with white pile extending halfway down cheeks. White hair on prothorax; long hair on pronotum, pale brown, on remainder of the body black; abdominal tergites clothed in black pile except on seventh segment, which is red, also thin apical fringe on sixth tergite; underside of posterior tarsi with golden-brown hair. Scopa black. Antennæ fuscous. Wings pale brown.

Clypeus very finely, densely reticulate punctate, with longitudinal shining area distinct, apical margin narrowly impunctate, finely undulate. Distance between hind ocelli and eyes about two-thirds of that between them and the occiput. Mesonotum and scutellum finely, densely granulate, covered with black pile. Hair of propodeon short.

Length 14 mm.

♂.—Unknown.

S. Dutch New Guinea: Mimika R., 4 ♀♀, 1911; Utakwa R., 1 ♀, 1913 (*A. P. R. Wollaston*).

Megachile regina, sp. n.

♀.—Black. Head densely covered with red pile, extending halfway down the cheeks, longer on the face, dense on clypeus; pile of seventh abdominal segment orange, of remaining tergites and mesonotum black; scopa black. Wings light brown.

Clypeal margin shining, weakly produced in the centre, remainder undulate. Proportions of back of the head and sculpture of mesonotum as in *tertia*.

Length 17 mm.

♂.—As ♀, but antennæ long, extending to about the middle of scutellum. Puncturation of clypeus regular, rather sparse in the centre, no longitudinal carina; disc with very sparse hair, apical fringe long and dense, sixth abdominal tergite with red pile except the apical margin, which is bowed outwards, fovea deep.

Near *tertia*, but distinguished by the form of the apical margin of clypeus as well as by the larger size and red clothing of the head.

Papua: Kokoda, 1200 ft., 1 ♀ (type), 1 ♂, v. 1932; Oquali, 4500 ft., 8 ♀♀, vii. 1932 (*L. E. Cheesman*). Type in B.M.

Megachile pretiosa Fr., 1909, Ann. Mus. Nat. Hungary, vii. p. 251.

Redescribed.

♀.—Hair of head black, of thorax fuscous. Pile of abdominal tergites red except sides of first and discs of second, third, and fourth, which are black (apical margin of fourth red); disk of first with rather long white hair, pile of basal margin of second white; hair of underside of tarsi red. Wings dark brown with bluish irridescence.

Clypeal margin with narrow shining area centrally, weakly undulate, longitudinal carina entire. Proportions of back of head as in *tertia*. Mesonotum and scutellum bare, shining, finely transversely striate-punctate, not densely.

Length 16 mm.

♂ (hitherto undescribed).—As ♀, but with dense white apical fringe on clypeus and tufts of white hair between antennæ. Clypeus shining, with fine, rather sparse punctures. Antennæ reaching to about the middle of scutellum. Seventh abdominal segment with margin weakly emarginate, fovea deep.

Papua: Kokoda, 1200 ft., 6 ♀♀, 1 ♂, iv. & ix. 1933; Oquali, 1 ♀, vii. 1933 (*L. E. Cheesman*).

Friese's type was from Queensland, but I cannot separate it from my series from Papua by his description.

Megachile elegans, sp. n.

♀.—Black. Hair of head black, very short, of face scanty, short, tawny fringes to inner margin of scape and lateral margins of clypeus; pile of mesonotum and scutellum black, of first abdominal tergite and base of second white. Scopa tawny gold, also hair of undersides of tarsi. Wings dark brown.

Puncturation of clypeus very dense, and minute, extending to apical margin, longitudinal carina indistinct anteriorly. Proportions of back of the head as in *tertia*. Mesonotum and scutellum finely granulate. Abdominal tergites (except first) not pilose, minutely reticulate-punctate, with sparse short depressed black hair.

Length 13 mm.

♂.—As ♀, but face clothed in tawny hair, sparse and very short on clypeus. Puncturation of clypeus irregularly reticulate, longitudinal carina distinct and entire. Antennæ reaching base of scutellum. Mesonotum and scutellum regularly finely punctate; abdominal tergites shining, puncturation sparse; hair of first tergite, lateral apical fringes of second, and third apical fringes of second to fourth sternites white.

N.E. Dutch New Guinea: Cyclops Mts., Sabron, 930 ft., 4 ♀♀, 3 ♂♂, v.-viii. 1936 (*L. E. Cheesman*). Type in B.M.

Key to Species.

Scopa tawny red. Vertex without pile.	
Pile of abdominal tergites tawny red ..	*lateritia.*
First abdominal tergite with white hair .	*lateritia* var. *albobasalis.*
Head and thorax with tawny-red pile ...	*rambutwan.*
Head and thorax without pile. Propodeon with white hair. Pile of first abdominal tergite white, of disks of second and third black	*midulator.*
Scopa red. No white hair on propodeon.	
Pile of abdominal tergites red; disks of second to fourth black	*pretiosa.*
Pile of all abdominal tergites red	*lateritia* subsp. *malayana.*
Vertex with red pile..................	Subsp. *malayana* var.
Prothorax with white hair	Var. *lorentzi*. [*auriceps.*
Scopa black. Prothorax without white hair.	
Vertex with white pile. Pile of mesonotum and abdominal tergites black, except on apical segment, which is red .	*tertia.*
Vertex with red pile..................	*regina.*
Scopa tawny gold. Vertex without pile. Pile of first abdominal tergite white, remaining tergites without pile	*elegans.*

XXVIII.—*The Subgenus* Cyrtomyrma *Forel of* Polyrhachis *Smith, with Descriptions of new Species, etc.* By Horace Donisthorpe, F.Z.S., F.R.E.S., etc., Department of Entomology, British Museum (Natural History).

The subgenus *Cyrtomyrma* was founded by Forel in 1915, with *Polyrhachis rastellata* Latreille as sub-genotype. The head is rounded at the sides and generally broader than the thorax. The thorax is usually broadest in front, narrowed to base, and without a trace of side margins.

The anterior angles of the pronotum are either more or less toothed or spined, or more or less rounded. The epinotum is short and without a distinct declivity · it is either armed with two longer or shorter teeth, or entirely unarmed. The scale of the petiole is furnished with four short spines. The colour of the body is usually black and shining; and the legs either black or partly red. All the species are finely reticulated, with small scattered punctures. As Emery points out, the species have a strong superficial resemblance to *Acanthomyops* (*Dendrolasius*) *fuliginosus* Latr., of Europe.

Distribution.—Central Hindostan, Ceylon, Indo-China, Malaysia, Papuosa, and Australia.

Considerable confusion has arisen in the so-called group *rastellata*, chiefly caused by the meagre description of Smith's *lævissima*, 1859 (nec *lævissima* Smith, 1858) = *levior* Roger. Smith never mentioned in his description whether the shoulders were rounded or toothed, and it was unfortunately concluded that they were rounded. Thus both Santschi and Viehmeyer placed *levior* in the wrong sections in their tables on this group. Forel also in his table in "Les Formicides de l'Empire des Indes et de Ceylan," Journ. Bombay Nat. Hist. Soc. viii. p. 21 (1893), places *levior* in the section with rounded shoulders.

Professor D. Hale Carpenter of the Hope Department, Oxford University Museum, has kindly lent me Smith's type, and I have redescribed the species. Miss Tassart has kindly figured it (and other species) for me.

Other mistakes have also crept in:—*P. lævissima* Smith, 1858, is said to be absolutely without punctuation, whereas it is reticulated and punctured in the same manner as all the other species of the subgenus. *P. rastellata* Latr. is said to be entirely black, whereas the legs are red as originally described by Latreille. As Emery points out, some of the so-called subspecies and varieties in this group have been mistaken for the typical form and have been recorded as such, thus confusing the distribution. Some of the forms have been treated as varieties of *levior*, and that species itself as a subspecies of *rastellata*; whereas the latter has the shoulders rounded and the epinotum entirely unarmed. I have treated all the so-called subspecies as species; and though this is not of much importance, it certainly simplifies matters.

I have not dealt with the males in this paper as there are no good characters to separate those of *Polyrhachis* from *Camponotus*. In the former genus the thorax and petiole are never armed with spines or teeth.

I have divided them into two groups: (1) those with the shoulders toothed and the epinotum armed or unarmed and (2) those with the shoulders rounded and the epinotum armed or unarmed.

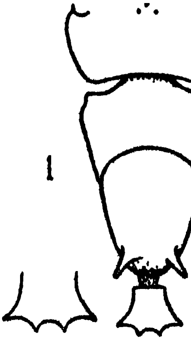
Group 1. Shoulders toothed or angled.

a. Epinotum armed.

1. *Polyrhachis* (*Cyrtomyrma*) *levior* Roger, Verz. Formicil. no. 232, p. 8 (1863) in Berlin Ent. Zeits. vii. Supplement, p. 8 (1863). (Fig. 1.)

Polyrhachis lævissima Smith, Journ. Proc. Linn. Soc. Lond., Zool. iii. p. 141 (1859) (nec *lævissima* Smith, 1858).

☿. Black, shining, greater part of legs, claws, and maxillary palpi red; antennæ, coxæ, knees, and tarsi black. The whole body is finely but distinctly reticulated, and with very small fine scattered punctures.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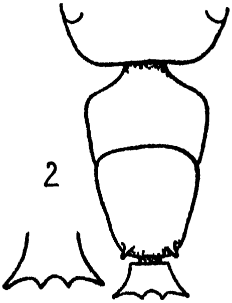
Polyrhachis (*Cyrtomyrma*) *levior* Roger. Worker. Part of head, thorax, scale, and scale enlarged.

Head transverse posteriorly, sides rounded from behind eyes to posterior angles, which are distinct, emarginate posteriorly, narrowed anteriorly; *mandibles* very finely striate and punctate, armed with four sharp teeth; *clypeus* large, convex, with two short acute teeth on anterior border; *frontal area* indistinct; *frontal furrow* distinct, extending between the frontal carinæ for about 2/3 of their length; *frontal carinæ* with sharp edges, emarginate in front, almost parallel behind, space between concave ; three small but distinct *ocelli* present ; *eyes* moderately prominent. *Thorax* with very distinct bluntly toothed anterior angles to the *pronotum*, slightly and shortly emarginate behind the tooth ; *epinotum* armed with two strong fairly long pointed spines, projecting outwards and very slightly downwards ; *petiole* * armed with four acute teeth, the outer pair being the longer, the inner pair bending slightly backwards.

Long. 5·8 mm.

Locality.—Aru (*A. R. Wallace*).

Type in Hope Department, Oxford University Museum.



Polyrhachis (*Cyrtomyrma*) *nox*, sp. n. Worker.
Part of head, thorax, scale, and scale enlarged.

2. *Polyrhachis* (*Cyrtomyrma*) *nox*, sp. n. (Fig. 2.)

☿. Black with legs mostly dark brown, almost black in some specimens ; antennæ and tarsi black, palpi brown, claws and trochanters reddish. This species comes near to *levior*, but the head is not so broad, more rounded, especially posterior angles, less emarginate posteriorly, the ocelli are less distinct ; the shoulders are blunter, the dorsal surface of the thorax is more convex, the epinotal spines are not so long, and the outer teeth on the petiole are longer and sharper.

Long. 5·8 mm.

Locality.—Mackay, Queensland, Australia (*R. E. Turner*).

Described from six workers in Brit. Mus. Coll.

Type in Brit. Mus. Coll.

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* Santschi's figure of the scale of *levior* is not accurate ; but, of course, he had never seen the type [' Le Naturaliste,' xxiv. (s.2) p. 284 (1910)].

3. *Polyrhachis* (*Cyrtomyrma*) *albertisi* Emery, Ann. Mus. Stor. Nat. Genova, xxiv. p. 240 (1887).

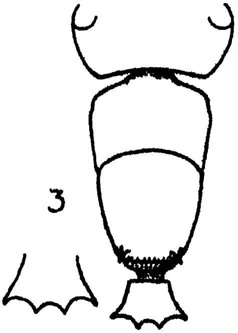
"☿. Nigra, nitida, subtilissime reticulata, oblonge sparse punctata, pube microscopica fere nulla, supra parce pilosa. Caput latum. Thorax dorso valde convexo, pronoti angulis anticis dente valido, apice haud acuto armatis, metanoto denticulo utrinque minuto. Squama acute quadridentata. L. 6½–7 mm.

"♀. Operariæ similis, et fortius sculpta, thoracis angulis anticis obtusis, haud dentatis, dentibus metanoti majoribus, squamæ minus acutis. L. 9 mm. Alæ colore solito tinctæ."

Locality.—Sorong, New Guinea (*L. M. D'Albertis*).

Emery states this species differs from the rest of the *rastellata* group by the condition of the points of the shoulders and scale * (*rastellata* has the shoulders and epinotum unarmed); but he did not compare it with *levior*, as he was unaware that that species has distinctly dentate shoulders. *P.* (*C.*) *albertisi* is evidently a rather large species, with all black legs, and less prominent shoulders than *levior*.

3



Polyrhachis (*Cyrtomyrma*) *mondoi*, sp. n. Worker. Part of head, thorax, scale, and scale enlarged.

4. *Polyrhachis* (*Cyrtomyrma*) *mondoi*, sp. n. (Fig. 3.)

☿. Black, shining, the trochanters, femora, and tibiæ dark red, the antennæ (except the tip of the last joint, which is red) and tarsi black. The teeth of the mandibles, and claws red; the palpi brownish yellow. The sculpturation consists of the usual fine reticulation and small punctures, but the pleural region of the mesonotum and epinotum, and the sides of the petiole are somewhat rugose in appearance, caused by the presence of long shallow punctures.

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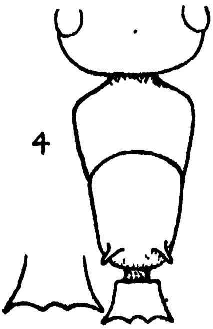
* I think Emery must have meant epinotum, as *rastellata* has four acute teeth on the scale of the petiole.

The head is less broad posteriorly than in *levior* and *nox*, and the posterior angles are less distinct than in the former and more so than in the latter. The shoulders are less marked than in the other two; the spines of the epinotum are of about the same length as in *nox*, but finer and sharper, and point slightly outwards. The teeth of the petiole are about the same length as in *levior*, but somewhat more acute.

Long. 5·5 mm.

Locality.—Mondo, Papua, 5000 ft. (*Miss L. E. Cheesman*).

Type in Brit. Mus. Coll.



Polyrhachis (*Cyrtomyrma*) *townsvillei*, sp. n. Worker. Part of head, thorax, scale, and scale enlarged.

5. *Polyrhachis* (*Cyrtomyrma*) *townsvillei*, sp. n. (Fig. 4.)

☿. Black, shining palpi, insertion of antennæ, part of coxæ, trochanters, femora, and tibiæ yellowish red; tarsi, antennæ, and mandibles dark red; teeth and knees infuscate; base of gaster distinctly reddish. The usual reticulation, the small scattered punctures on gaster more distinct than in *levior*.

Head narrowed in front, rounded behind eyes; posterior angles and emargination of posterior border not so marked as in *levior* and *nox*; *clypeus* convex, notched and projecting anteriorly, the teeth at the corners not so acute as in *levior* or *nox*. Three very small, somewhat indistinct *ocelli* present. *Thorax* rather more convex than in *levior* and *nox*; *pronotum* broadest a little behind anterior angles, which are distinctly angled, but not nearly so much as in *levior* and less so than in *nox*; *epinotum* armed with two teeth, considerably smaller than in *levior*, about the same length as in *nox*, but slightly thinner; *petiole* armed with four sharp teeth, those in the centre slightly nearer together and shorter than in *levior* and *nox*, the outer ones longer than in *levior* and shorter than in *nox*.

Long. 5·7 mm.

♀. Similar to the ☿, but the colour of the antennæ and legs is considerably darker, the shoulders are quite rounded, and the teeth on the epinotum and scale are longer and thicker. *Wings* yellowish, pterostigma and veins darker.

Long. 7·2 mm.

Locality.—Townsville, Queensland (*Dod*); ex coll. Donisthorpe.

Type in Brit. Mus Coll.

b. Epinotum unarmed.

6. *Polyrhachis* (*Cyrtomyrma*) *lævissima* Smith, Cat. Hym. Brit. Mus. vi. p. 64, pl. iv. fig. 42 (1858). (Fig. 5.)

☿. Black, shining; teeth of mandibles, palpi, coxæ, trochanters, femora, tibiæ, claws, and projecting portion of petiole beneath red; antennæ and tarsi black, knees infuscate. Whole body very finely reticulate and with very small scattered punctures (less distinct than in *levior*); the pleural area and sides of petiole finely striate. *Head* transverse posteriorly, sides behind eyes rounded, but not quite so abruptly as in *levior*, posterior angles distinct, posterior border emarginate, narrowed anteriorly; *mandibles* with larger and smaller punctures and conspicuous short decumbent bristles, armed with four sharp teeth; *clypeus* large, convex, projecting anteriorly with four sharp teeth, emarginate between; *frontal area* indistinct; *frontal furrow* distinct, reaching back as far as the base of frontal carinæ; *frontal carinæ* with sharp edges emarginate in middle, slightly narrowed at base; no trace of *ocelli*; *eyes* slightly less prominent than in *levior*. *Thorax* with anterior angles of the *pronotum* acutely toothed, not emarginate beneath tooth, dorsal surface convex; *epinotum* without a trace of spines;

petiole simply notched in middle, with pointed angles at the sides (these side teeth are greatly exaggerated in Smith's figure).

Long. 5·3 mm.

Locality.—Burma.

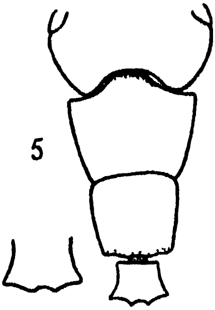
Type in Brit. Mus. Coll.

♀. Very like the ☿ in colour etc.; the sculpturation, however, is stronger and the shoulders are quite rounded.

Long. 8–10 mm.

Bingham records the species from Bengal, Orissa, Assam, Burma, Tenasserim, Siam, and down to Java.

5



Polyrhachis (*Cyrtomyrma*) *lævissima* Smith. Worker. Part of head, thorax, scale, and scale enlarged.

The *P. globularia* Mayr [Tijds. v. Ent. x. p. 41 (1867)], which is recorded from Java, is said to be a synonym of *lævissima*.

Bingham's figure of the scale is good, but not of the shoulders.

Polyrhachis (***Cyrtomyrma***) ***lævissima*** Smith var. ***dichroa*** Forel, Journ. Bombay Nat. Hist. Soc. viii. pp. 21, 30 (1893).

☿. Gaster and legs reddish yellow; antennæ and the front of the head reddish.

Locality.—Assam (*Wood-Mason*).

Polyrhachis (***Cyrtomyrma***) ***lævissima*** Smith var. ***aruensis*** Viehmeyer, Abh. Zool. Anthrop. Mus. Dresden, xvi. No. 1, p. 9 (1912).

☿. "Unterscheidet sich von dem Typus vor allem durch die scharf zugespitzten und langgezogenen Zähne der Schuppe (ähnlich wie bei *rastellata*). Beine mehr oder weniger pechbraun, abschüssige Fläche des Epinotums ungefähr in der Höhe der Metathoraxstigmen jederseits mit einem sehr kleinen, stumpfen, buckelförmigen Zahnrudiment. Thorakalseiten kräftiger und rauher skulpiert und darum matter. Die zahnförmigen Vorderecken des Pronotums ebenso wie die Zahnrudimente des Epinotums in ihrer Grösse variabel. L. 5–6 mm."

Locality.—Aru (*C. Ribbe*).

Viehmeyer records it as in numbers in his collection. I very much doubt if this insect should be considered to be a variety of *lævissima*.

7. *Polyrhachis* (*Cyrtomyrma*) *vitalisi* Santschi, Bull. Soc. Vaud. Sci. Nat. lii. p. 567 (1920).

This species is related to *lævissima*, but is larger and entirely dull. The legs are black except the borders of the trochanters, which are reddish.

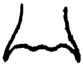
Long. 6·5–7 mm.

Santschi gives a long and careful description of all three castes.

Locality.—Laos (*Vitalis de Salvaza*).

8. *Polyrhachis* (*Cyrtomyrma*) *gibba* Emery, Zool. Jahrb. xiv. p. 580, Tf. *a*, *b* (1901). (Fig. 6.)

☿. This insect has a bluish reflection, the head and thorax are very slightly shining, and the legs are black. The anterior angles of the pronotum are armed with small somewhat outreaching teeth. The side teeth of the petiole are longer than in *lævissima*.



Polyrhachis (*Cyrtomyrma*) *gibba* Emery.
Scale after Emery.

Long. 5·5 mm.

Locality.—Celebes (*Fruhstorfer*).

Group 2. Shoulders rounded.

a. Epinotum unarmed.

9. *Polyrhachis* (*Cyrtomyrma*) *rastellata* Latreille, Fourmis, p. 130 (1802). (Fig. 7.)

"La Fourmi A Rateau. *Formica rastellata*.

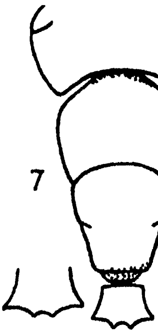
" *Femelle.*

" Noir, lisse et luisante ; corcelet rond ; écaille quadridentée

" Nigra, lævis, nitida ; thorace rotundo ; squama quadridentata.

" Long. $0^{m}\cdot005$–2 lig. $\frac{1}{5}$.

" Elle a presque le facies de la fourmi portepique. Le corps est d'un noir très-lisse, glabre et luisant La tête a les trois petits yeux lisses. Le corcelet est rond et convexe. L'écaille est triangulaire, avec quatre petites dents au sommet, dont les latérales plus basses. L'abdomen est ové-conique. Les pattes sont d'un rouge-brun, avec les tarses noirs. Les ailes manquent à l'individu que je décris et qui vient des Indes orientales, où il a été recueilli par Riche Il fait partie de la collection de Bosc."



7

Polyrhachis (*Cyrtomyrma*) *rastellata* Latr. Worker. Part of head, thorax, scale, and scale enlarged.

☿. Black, shining, with the usual reticulation and very small punctures ; insertion of the antennæ, trochanters, femora, tibiæ, and claws blood-red ; mandibles, antennæ, and tarsi black ; knees blackish.

Head broad, massive, broader than thorax, narrowed in front, rounded from eyes to posterior angles, which are distinct, posterior border emarginate ; *mandibles* armed with rather blunt teeth ; *clypeus* large, convex, anterior border projecting with a prominent tooth at each corner ; *frontal area* indistinct ; *frontal carinæ* raised with sharp edges, emarginate anteriorly and very slightly contracted posteriorly ; *frontal furrow* reaching between the carinæ for two-thirds of their length ; *eyes* large, very round and prominent. *Thorax* broad, massive, convex ; *pro-mesonotal suture* deep and conspicuous ; *meso-epinotal suture* faintly indicated ; *scale* with four pointed teeth, the outer pair being the longer, the inner pair rather close together, nearer to each other than to the outer pair. The scale is slightly transversely striate on its anterior portion and the pleural region is slightly rugose, but this is more or less present in most of the species.

Long. 5·5 mm.

Described from an Indian specimen (*Wroughton*). Most of the examples in the Brit. Mus. Coll., are from Ceylon, the legs are lighter and the teeth of the scale sharper and might be called var. *ceylonensis* nov. var. Emery gives for the distribution—Ceylon, Kanara, Hindo-China, Hindo-Malasian Isles as far as New Guinea and Queensland ; but, as he justly remarks, the distribution of the typical form is without doubt confined to a very small portion of these localities ; and probably to the most oriental regions.

Polyrhachis (*Cyrtomyrma*) *rastellata* Latr. var. *celebensis* Viehm. Arch. f. Naturg. lxxix. p. 51 (1913).

☿. Front angles of the pronotum with the indication of a tooth.

Locality.—Celebes.

The above appears to be the whole of Viehmeyer's description ! As he puts it in the section without toothed shoulders, and as he queries if the typical form has the thorax broadest in front, it would seem that this insect requires to be redescribed.

Polyrhachis (*Cyrtomyrma*) *rastellata* Latr. var. *pilosa* Forel, Rev. Suisse Zool. x. p. 527 (1902).

"☿. Métanotum sans trace d'épines. Très semblable à la var. *debilis* Emery, mais tout le corps assez abondamment pourvu de poils dressés fins. Çà et là même un poil sur les pattes."

Locality.—New South Wales (*Froggatt*).

Forel gives this as a var. of *levior*, and he says the var. *debilis* Emery of *levior* is itself closely related to *rastellata* ; *levior*, however, as we have seen, has both the shoulders and the epinotum well armed ; and *debilis* has the shoulders rounded and very small teeth to the epinotum. I consider both to be good species.

Polyrhachis (*Cyrtomyrma*) *rastellata* Latr. var. *fulakora* Mann. Bull. Mus. Compar. Zool. Harvard, lxiii. p. 389 (1919).

♀. This variety agrees with *rastellata*, but the legs are very dark reddish brown instead of blood-red. This character is constant in a large series from many colonies.

Long. 6·5 mm.

Locality.—Solomon Islands (*Mann*).

A specimen in the Brit. Mus. Coll. from New Guinea agrees with cotypes from Mann.

Polyrhachis (*Cyrtomyrma*) *rastellata* Latr. var. *yorkana* Forel, Arkiv f. Zool. ix. p. 110 (1915).

☿. This variety according to Forel differs from " race *levior* Rog "; by the complete lack of teeth to the epinotum. The centre teeth of the scale are shorter than in the typical form, and the head is broader behind.

Long. 4·9–5·6 mm.

Locality.—Cape York, Queensland (Mjöberg's expedition).

10. *Polyrhachis* (*Cyrtomyrma*) *ralumensis* Forel, Mit. Zool. Mus. Berlin, ii. p. 34 (1902).

Entirely black. It differs from *rastellata* and *euralus* var. *goramensis* by its larger size and especially by its much larger head, which is exceptionally broad and short, broader than long, and less narrowed in front. The eyes are placed a little more forward, and three distinct ocelli are present. There is a distinct suture between the mesonotum and the epinotum. The teeth of the scale are larger than in *rastellata*, but the lateral ones much shorter than in v. *goramensis*.

Long. 7 mm.

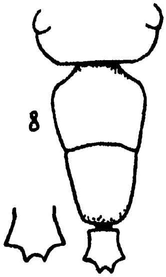
Locality.—Bismarck Archipelago.

Stitz's *P. rastellata* Latr. var. *major* from German New Guinea is given as a synonym of *ralumensis* For.

11. ***Polyrhachis* (*Cyrtomyrma*) *burmanensis*, sp. n.** (Fig. 8.)

☿. Black, shining, usual sculpture; legs dark brown, antennæ and tarsi black, palpi light brown.

The *head* is considerably narrower than in *rastellata*, not much broader than the thorax, the anterior margin of the *clypeus* projects much less, and the corner teeth are much less prominent; the teeth of the *mandibles* are sharper. The *thorax* is more slender, not so massive, nor so convex; the *pro-mesonotal suture* is narrower and less marked, the posterior part of the thorax is much rounded, and there is no trace of a *meso-epinotal suture*. The *scale* is considerably narrower; the *teeth* are smaller, the centre ones being longer than the outer ones.

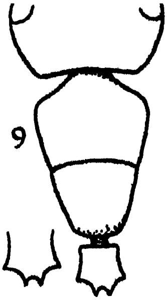


Polyrhachis (*Cyrtomyrma*) *burmanensis*, sp. n. Worker.
Part of head, thorax, scale, and scale enlarged.

Long. 4·4 mm.

Locality.—Upper Burma (ex Coll. Bingham).

Type in Brit. Mus. Coll.



Polyrhachis (*Cyrtomyrma*) *mackayi*, sp. n. Worker.
Part of head, thorax, scale, and scale enlarged.

12. *Polyrhachis* (*Cyrtomyrma*) *mackayi*, sp. n. (Fig. 9.)

Black, shining, usual sculpture; legs dark brown, antennæ and tarsi black, palpi light brown.

Head as in *rastellata*, but not so broad, broader than in *burmanensis*. *Thorax* not nearly so massive and broad as in *rastellata*, but broader than in *burmanensis*. *Scale* narrow as in the latter, but with smaller blunter teeth.

Long. 4·7 mm.

♀. Similar to the ☿, except the usual caste differences, but the shoulders are more rounded and the teeth on the scale are blunter.

Long. 6·3 mm.

Locality.—Mackay, Queensland (*R. E. Turner*).

Type and ♀ type in Brit. Mus. Coll.

13. *Polyrhachis* (*Cyrtomyrma*) *euryalus* Smith, Proc. Linn. Soc. Lond. vii. p. 16 (1863). (Fig. 10.)

☿. "Length 2½ lines. Black, smooth, and shining; the thorax rounded above, not spined; the outline when viewed laterally semi-circular; the legs obscure ferruginous. Abdomen globose; the node of the peduncle with four spines, the two inner ones shorter than the lateral pair, but all short and acute. *Hab.* Mysol."

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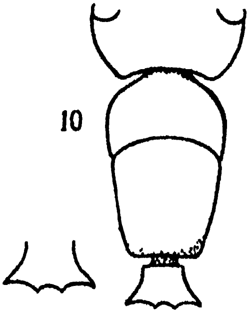


Polyrhachis (*Cyrtomyrma*) *euryalus* Smith. Worker. Part of head, thorax, scale, and scale enlarged.

Type in Hope Department, Oxford University Museum.

In a cotype in the Brit. Mus. Coll. the legs are very dark brown, the antennæ and tarsi black; the *pronotum* is broadest in the middle.

Long. 5 mm.

It is a smaller much more slender ant than *rastellata*.

Locality.—Mysol (*A. R. Wallace*).

Emery gives this species as a subspecies of *rastellata*, and the var. *torricelliana* Viehm. as a synonym.

Viehmeyer, Abh. Zool. Anthropl Mus. Dresden, xiv. No. 1, p. 9, fig. 11 *a* (1912) says it comes very near to the var. *goramensis* Emery, but smaller and with much smaller teeth to the scale. In his table, however, Arch. f. Naturg. lxxix. p. 51 (1913), he queries it as a synonym of *euryalus* Smith, but states that the teeth of the scale are longer than in *V. goramensis* Emery!

Polyrhachis (*Cyrtomyrma*) *euryalus* Smith var. *goramensis* Emery, Ann. Mus. Stor. Nat. Genova, xxiv. p. 239 (1887).

☿. Emery says that this variety is larger than *rastellata* Latr., of which species he treats it as a variety, and that the lateral teeth of the scale are longer.

Locality.—Isle Goram (*L. M. d'Albertis*).

Polyrhachis (*Cyrtomyrma*) *euryalus* Smith var. *javana* Viehm. Arch. f. Naturg. lxxix. pp. 51–2, fig. 11 (1913).

☿. "Mit *euryala* F. Sm. (*torricelliana*) verglichen: Schlanker. Kopf hinter den Augen etwas mehr veregnt; Thorax schmäler und etwas langer, nicht so hoch, von vorn nach hinten flacher gewölbt; abschüssige Fläche des Epinotums nicht so steil, Winkel zwischen ihr und der Basalfläche grösser. Zähne der Schuppe wie bei *rastellata*. Skulptur wie bei der Unterart (=*euryalus*). Beine bis auf die Knie und Tarsen, Spitze des Fühlerschaftes und das äusserste Ende der Geissel rot; im übrigen glänzend schwarz. L. 5·5 mm."

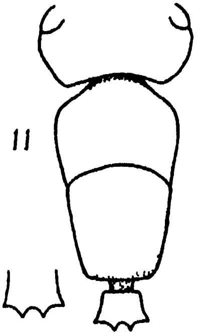
Locality.—East Java.

14. *Polyrhachis* (*Cyrtomyrma*) *ugiensis* Mann, Bull. Mus. Compar. Zool. Harvard, lxiii. p. 389 (1919). (Fig. 11.)

☿. Mann gives this insect as a subspecies of *rastellata* Latr., and writes: "The specimens from the eastern Solomons represent still another form of this variable species, characterized by the shorter spines of the petiole, which in some specimens have the lateral ones reduced to mere angles, and in the colour of the legs. The femora and the tibiæ are reddish brown, with the bases of the latter and the tarsi black. The antennæ are black, except the extreme tip of the last segment, which is brown."

Long. 5·5–6 mm.

Locality.—Solomon Islands (***Mann***).



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Polyrhachis (*Cyrtomyrma*) *ugiensis* Mann. Worker. Part of head, thorax, scale, and scale enlarged.

15. *Polyrhachis* (*Cyrtomyrma*) *luctuosa* Emery, Bull. Soc. Vaud. Sci. Nat. liv. p. 25 (1921).

☿. "Noire, pattes tendant au roux, absolument mate, densément et finement ponctuée sur presque tout le corps et sur les membres ; les mandibles, l'extrémité et le dessous du gastre sont plus ou moins luisants. Pubescence très courte et éparse. Des poils dressés blanchâtres, courts, sont semés sur la tête et le gastre. Pareille pour la forme du corps à *P. rastellata*, mais le corselet est encore plus court et plus bossu. Les dents latérales de l'écaille ne sont guère plus longues que les médiales. L. environ 6·5 mm."

Locality.—New Guinea.

16. *Polyrhachis* (*Cyrtomyrma*) *fornicata* Emery, Ann. Mus. Stor. Nat. Genova, xl. p. 720 (1899).

☿. This ant, which Emery treated as a subspecies of *rastellata* Latr., differs from the latter by the inner teeth of the scale being less high and acute, and less distant from the lateral ones. It possesses a slightly metallic reflection, and the legs are often reddish, though darker than in the typical form.

Locality.—Celebes.

b. Epinotum armed.

17. *Polyrhachis* (*Cyrtomyrma*) *linæ*, sp. n. (Fig. 12.)

☿. Black, shining; legs dark brown, anterior tibiæ lighter, antennæ, coxæ, and tarsi black, palpi yellow, claws red. Usual reticulation and small scattered punctures, but the epimera of thorax and base of front of scale almost rugosely punctured, the anterior portion of the latter transversely striate.

Head transverse posteriorly, posterior angles distinct; *mandibles* finely punctured and longitudinally striate, the punctures large near the teeth, furnished with sharp teeth, the small tooth at the corners of the slightly projecting anterior margin of *clypeus* small, but sharp and distinct. *Thorax* convex, anterior angles of *pronotum* rounded, broadest a little before the centre; *pro-mesonotal suture* well marked, *meso-epinotal suture* faintly indicated;

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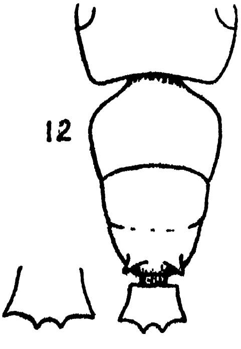

Polyrhachis (*Cyrtomyrma*) *linæ*, sp. n. Worker. Part of head, thorax, scale, and scale enlarged.

epinotum armed with two short sharp spines projecting outwards and upwards; the *declivity* of the epinotum is somewhat abrupt and about as long as the anterior surface; *scale* armed with four short teeth of about equal length, the centre ones nearer to each other than to the lateral ones.

Long. 6·2 mm.

♀. Similar to ☿, puncturation of *head* stronger; spines on *epinotum* and *scale* blunter. *Wings* dusky; *pterostigma* and *veins* yellow.

Long. 7·6 mm.

Locality.—Dutch New Guinea, Cyclops Mountains. Mt. Lina, 3500 ft. Five workers and three winged females taken by Miss L. E. Cheesman, February 1936.

☿ and ♀ type in Brit. Mus. Coll.

18. *Polyrhachis* (*Cyrtomyrma*) *emeryana* Mann, Bull. Mus. Compar. Zool. Harvard, lxiii. p. 391, fig. 59 (1919).

☿. A full description is given by Mann (*l. c.*): the epinotal spines nearly straight, a little shorter than their distance apart at base. The inner pair of spines on the scale are triangular, as broad at base as long; the lateral ones are elongate-triangular, acute, and four times as long as the inner pair. This species is near *leonidas* Forel, but smaller, the meso-epinotum less convex, the spines smaller and more cylindrical, and the outer pair of spines on the scale very much longer in proportion to the inner pair than in that species.

Long. 5 mm.

Locality.—Malaita, Auki, Solomon Islands (*Mann*). One worker.

19. *Polyrhachis* (*Cyrtomyrma*) *wagneri* Viehm. Arch. f. Naturg. lxxvii. p. 51, fig. 10 (1913).

☿. Pure black and very shining; the epinotum armed with a pair of small teeth; the scale of the petiole exceptionally broad, armed with two very short central teeth and long widely divergent lateral ones.

Long. 6 mm.

Viehmeyer says this species is near to *leonidas* Forel, but the head is smaller posteriorly, the eyes more convex, the thorax more arched, and the pronotum shorter. He also compares it with *levior* Roger; but as he did not know what that species is like, it is of no value.

Locality.—New Guinea.

20. *Polyrhachis* (*Cyrtomyrma*) *doddi*, sp. n. (Fig. 13.)

Black, very shining; insertion of antennæ, trochanters, femora, tibiæ, and claws red; palpi light brown; antennæ black, with extreme apex of scape, and of the joints of funiculus, and tip of last joint, mandibles anteriorly, and teeth reddish; knees blackish; tarsi black with extreme apex of joints reddish. The reticulation forms a more or less circular pattern; the greater part of the sides of the thorax and petiole are longitudinally striate, almost rugose. The whole body is covered with very short, extremely fine, scattered pubescence.

Head rounded from behind eyes, posterior angles not marked, posterior border slightly emarginate, rather sharply narrowed in front; *mandibles* armed with rather blunt teeth; *clypeus* not very convex, tooth at the corners of anterior border very small and not very prominent; a shallow furrow occurs behind the posterior border of the clypeus and before the *frontal area*; the latter quite undefined; the *frontal furrow* reaches between the frontal carinæ, more than two-thirds of their length. *Thorax* considerably arched; *pronotum* broadest in front with shoulders not so rounded as in *rastellata*; *epinotum* armed with two sharp spines projecting outwards and slightly downwards at apex; *scale* armed with two short rather blunt teeth in centre, and with two sharp, longer, divergent lateral ones.

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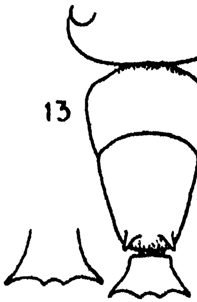


Polyrhachis (*Cyrtomyrma*) *doddi*, sp. n. Worker.
Part of head, thorax, scale, and scale enlarged.

Long. 4·9–6·6 mm.

♀. Similar to ☿, *shoulders* more rounded; teeth to *epinotum* and *scale* thicker. *Wings* yellowish; *pterostigma* and *veins* light brown.

Long. 8 mm.

Locality.—Queensland) *E. P. Dodd*).

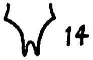
☿ and ♀ type in Brit. Mus. Coll.

21. *Polyrhachis* (*Cyrtomyrma*) *demangei* Sants. Le Naturaliste, xxxii. p. 284 (1910). (Fig. 14.)

☿. This species is entirely black, including the legs, smooth and shining. The epinotum is armed with two strong teeth curving back at the apex, and the scale with two long median teeth and two much lower, shorter, lateral teeth.

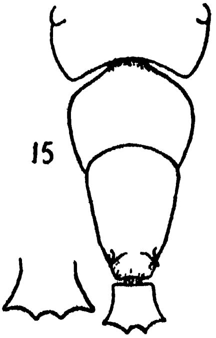
Long. 4·5–6 mm.

Santschi, who treats it as a subspecies of *rastellata* Latr., says the antennæ are a little thicker, the pronotum more elongate, and the lateral teeth of the scale are situated much lower and are less separated than in that species and in *leonidas* Forel. It differs from *rastellata* in having black legs, but Santschi, unfortunately, placed the latter in the section of his table " Entièrement noire." He also says this form is intermediate between *levior* and *leonidas*, but, as was the case with Viehmeyer, he did not know the former species.



Polyrhachis (*Cyrtomyrma*) *demangei* Sants.
Scale after Santschi.

Locality.—Tonkin.



Polyrhachis (*Cyrtomyrma*) *debilis* Emery. Worker.
Part of head, thorax, scale, and scale enlarged.

22. ***Polyrhachis*** **(*Cyrtomyrma*)** ***debilis*** **Emery, Ann. Mus. Stor. Nat. Genova, xxiv. p. 240 (1887). (Fig. 15.)**

☿. Emery gives this species as a var. of *levior* Rog., from which he says it differs in the fact that the spines of the epinotum are reduced to very small teeth. Emery also did not know *levior*, which he thought had rounded shoulders, whereas, as we have seen, that species has strongly toothed anterior angles to the pronotum. He, however, said it was doubtful whether to refer his var. to *levior* or *rastellata*. He gives the locality as New Guinea, Fly River (*L. M. d'Albertis*); Aru (*Beccari*).

A form from Papua was named v. *debelis* for us by the late Professor Wheeler. As, however, it has nothing to do with *levior* and differs considerably from *rastellata*, it would seem best to describe it more fully under the name of *debilis* Emery.

☿. Black, shining, with the usual reticulation; legs and palpi very dark brown; insertion of the antennæ and apex of trochanters reddish brown; antennæ black.

Head narrower than in *rastellata*; *clypeus* not very convex, anterior border not projecting with very small teeth at the corners, posterior border distinctly emarginate in centre. *Thorax* considerably arched; *pronotum* with shoulders rounded, considerably narrower than in *rastellata*, with more sloping shoulders; *epinotum* armed with two small sharp * teeth (evidently longer than in *wagneri* Viehm., according to Viehmeyer's figure); *scale* with similar but slightly longer teeth than in *rastellata*.

Long. 6–6·6 mm.

♀. Similar to ☿, but the shoulders are more rounded, the teeth of the *epinotum* reduced to small tubercules, those of the *scale* blunter. *Wings* yellowish; *pterostigma* and *veins* light yellowish brown.

Long. 7·7 mm.

Described from a number of workers, one winged female, and one deälated female (the queen) taken in a nest of leaves woven together with silk at Mafulu, 4000 ft., Papua by Miss L. E. Cheesman, xii. 1933. Males were also present in the nest. Miss Cheesman swept off herbage a number of workers of the same species at Kokoda.

Polyrhachis (*Cyrtomyrma*) *debilis* Emery var. *johnsoni* Mann, Bull. Mus. Compar. Zool. Harvard, lxiii. p. 390 (1919).

"Resembling *lævior* var. *debilis* Emery in having on the epinotum a pair of distinct, though very short and small spines. It is much larger in size than *debilis*, and the legs are uniformly dark brown, almost black. The thorax is evenly arched, much as in *leonidas* Forel, and the epinotal declivity in profile is straight."

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* The size of these teeth varies, being considerably reduced in some specimens.

Long. 7 mm.

Locality.—Solomon Islands (*Mann*). "One colony was found in a silk and *carton* nest on a palm leaf."

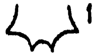
Mann treats this as a var. of *rastellata*, but it is evidently a var. of *debilis*, but larger. In the co-types in the Brit. Mus. Coll. the legs are lighter than in *debilis*, and the teeth to the epinotum are shorter, being almost tubercules. The latter character, however, probably varies as in *debilis*.

23. *Polyrhachis* (*Cyrtomyrma*) *leonidas* Forel, Mit. Zool. Mus. Berlin, ii. p. 34 (1902). (Fig. 16.)

Black; antennæ, coxæ, tarsi, mandibles, base of tibiæ, and hind border of the segments of the gaster brown; femora and tibiæ (except base) dirty yellowish or reddish yellow. The clypeus is flat and slightly concave from apex to base; the pronotum is only weakly arched from apex to base. The scale has a perpendicular hind surface, which is dull and somewhat strongly wavily striate reticulate.

Long. 6–6·5 mm.

Forel compares this species to *rastellata* and *levior* to which he says it is nearly related, especially to the latter.



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Polyrhachis (*Cyrtomyrma*) *leonidas* Forel.
Scale after Santschi.

As, however, he did not know what this species was like, his comparisons with it are useless.

The head is narrower behind, the eyes are larger, the thorax is much longer and much less arched. The epinotal teeth are said to be broader and a little shorter than in *levior*, the scale is said to be like that of *levior*, but thinner; and its four little teeth are all distinctly bent back in the form of a claw.

Locality.—Bismarck Archipelago.

XXIX.—*The Piaget Collection of Mallophaga.*—Part II.
By GORDON B. THOMPSON.

(Continued from Ann. & Mag. Nat. Hist. 1937, ser. 10, vol. xx. p. 27.)

Species.	No. of specimens in B.M.	No. of slides.	Hosts.
Colpocephalum abdominale Piaget.	3 ♀♀, 4 ♂♂.	4	*Grus leucauchen* (Japan).
C. aculeatum P.	1 ♀ *.	1	*Colymba iriditorquis.*
C. affine Nitzsch	4 ♀♀, 1 ♂.	3	*Totanus latirostris.* *Totanus ochropus.*
C. albidum Giebel	5 ♀♀, 1 ♂.	3	*Colymba phasionella.* *Phasianus torquatus.* " Pigeon domestique."
C. angulaticeps Piaget	1 ♀, 1 ♂.	1	*Fregata minor.*
C. assimile Piaget	3 ♀♀, 2 ♂♂.	3	*Grus mexicana.*
C. atrofasciatum Piaget	4 ♀♀, 1 ♂.	3	*Grus antiqua.*
C. atrofasciatum var. Piaget	5 ♀♀, 5 ♂♂.	5	*Grus pavonina.* *Balearica pavonina.*
C. biseriatum Piaget	5 ♀♀, 3 ♂♂.	3	*Gracula javanica.*
C. castaneum Piaget	3 ♀♀, 3 ♂♂.	3	*Cygnus atratus.*
C. caudatum Giebel	7 ♀♀, 3 ♂♂.	4	*Recurvirostra avocetta.* *Vultur tenuirostris.* *Harpygia guinensis.*
C. caudatum var. *setosa* Piaget	2 ♀♀.	1	*Helotarsus ecaudatus.*
C. caudatum var. *major* Piaget	4 ♀♀, 2 ♂♂.	2	*Gypogeranus serpentarius.*
C. caudatum var. *longipes* Piaget.	4 ♀♀, 3 ♂♂.	3	*Chunga burmeisteri.*
C. ciliatum Piaget	1 ♀, 1 ♂.	1	*Tallegallus novæguineæ.*
C. crassipes Piaget	1 ♀, 1 ♂.	1	*Sterna poliocera.*
C. dissimile Piaget	1 ♀, 1 ♂.	1	*Milvus ægyphacus.*
C. dissimile var. *major* Piaget	3 ♀♀, 3 ♂♂.	3	*Haliaëtus leucogaster.*
C. elongatum Piaget	3 ♀♀, 3 ♂♂.	3	*Pyrrhocorax alpinus.*
C. eurygaster Piaget	3 ♀♀, 2 ♂♂.	2	*Leptoptilus argala.*
C. femoratum Piaget	4 ♀♀, 2 ♂♂.	2	*Mycteria americana.*
C. flavescens Nitzsch	12 ♀♀, 8 ♂♂.	8	*Haliaëtus leucogaster.* *Strix nivea.* *Circætus cinereus.* *Haliaëtus albicilla.* *Haliastur indus.*
C. fuscipes Piaget	1 ♀.	1	*Larus dominicanus.*
C. fusconigrum Giebel	3 ♀♀, 3 ♂♂.	3	*Ibis melanocephala.*
C. gracile Piaget	1 ♀, 1 ♂.	1	*Platalea leucorodia.*
C. grandiceps Piaget	1 ♀, 1 ♂.	1	*Hæmatopus ostralegus.*
C. grandiceps var. Piaget	3 ♀♀.	2	*Pluvianus ægypticus.* *Bernicla brenta.*
C. heterosoma Piaget	9 ♀♀, 8 ♂♂, 2 imm.	7	*Phœnicopterus antiquorum.* *Phœnicopterus ruber.*
C. hirtum Rudow	1 ♀, 1 ♂.	1	*Buceros cassidix.*
C. importunum Nitzsch	8 ♀♀, 5 ♂♂.	5	*Ardea minuta.* *Ardea cinerea.*

---

* Only the male is mentioned in the original description. The specimen in the collection is undoubtedly a female.

Species.	No. of specimens in B.M.	No. of slides.	Hosts.
C. importunum var. *major* Piaget.	2 ♀♀, 2 ♂♂.	2	*Ardea garcetta.*
C. incisum Piaget	1 ♀ *.	1	*Phaëton flavirostris.*
C. latifasciatum Piaget	1 ♂.	1	*Rhynchops flavirostris.*
C. leptopygus Nitzsch	2 ♀♀, 1 ♂.	2	*Ibis peregrina.* *Ibis melanocephalo.*
C. longipes Piaget	2 ♀♀, 2 imm.	2	*Eclectus puniceus.* *Coracopsis nigra.*
C. maculatum Piaget	4 ♀♀, 3 ♂♂.	3	*Caracara brasiliensis.*
C. majus Piaget	1 ♀.	1	*Megapodium rubripes* var. *duperreyi.*
C. maurum Nitzsch	3 ♀♀, 1 ♂.	3	*Sterna nigra.* *Sterna anglica.* *Sula piscatrix* (? spelling).
C. minus Piaget	4 ♀♀, 1 ♂.	2	*Megapodium rubripes* var. *freycineti.* *Megapodium rubripes* var. *giberti.*
C. nanum Piaget	1 ♀.	1	*Larus canus.*
C. notatum Piaget	4 ♀♀, 2 ♂♂.	2	*Dicholophus cristatus.*
C. obscurum Giebel	1 ♂.	1	*Ardea egretta.*
C. occipitale Nitzsch	1 ♀, 1 ♂.	1	*Anastomus lamelligerus.*
C. ochraceum Nitzsch	6 ♀♀, 4 ♂♂, 2 imm.	7	*Vanellus cristatus.* *Sterna anglica.*
C. pachygaster Giebel	3 ♀♀, 3 ♂♂.	3	*Pandion haliaëtus.*
C. pachypus Piaget	1 ♂ †.	1	*Prionites brasiliensis.*
C. pallidum Piaget	2 ♀♀, 1 ♂.	1	*Plictolophus moluccensis.*
C. parviceps Piaget	4 ♀♀, 3 ♂♂, 3 imm.	4	*Lamprotornis æneas.* *Lamprotornis* sp. ?
C. patellatum Piaget	4 ♀♀, 2 ♂♂.	2	*Numenius arquatus.*
C. penicillatum Piaget	1 ♀, 2 ♂♂.	2	*Ibis rubra.* *Ibis cristata.*
C. pilosum Piaget	6 ♀♀, 3 ♂♂.	3	*Palamedea chavaria.*
C. pungens Piaget	1 ♀.	1	*Calornis panayensis.*
C. pustulatum Piaget	1 ♀.	1	*Gypogeranus cirratus.*
C. pustulosum Piaget	2 ♀♀, 2 ♂♂.	2	*Machetes pugnax.*
C. quadripustulatum Nitzsch	1 ♀ ‡.	1	*Ciconia alba.*
C. semicinctum Rudow	4 ♀♀, 2 ♂♂.	3	*Corvus scapulatus.*
C. setosum Piaget	6 ♀♀, 4 ♂♂, eggs.	5	*Dicholophus cristatus.* *Cathartes gryphus.*
C. spinosum Piaget	1 ♀, 1 ♂.	1	*Francolinus capensis.*
C. spinulosum Piaget	1 ♀, 1 ♂.	1	*Limosa melanura.*
C. subæquale Nitzsch	6 ♀♀, 1 ♂.	4	*Corvus corone.* *Corvus monedula.* *Corvus corax.*
C. subflavescens Piaget	2 ♀♀, 1 ♂.	2	*Platalea leucorodia.* *Xenorhynchus senegalensis.*

---

* The male only was described by Piaget, but the only specimen in the collection is almost certainly a female.

† A female is mentioned in the original description, but there is no female in the collection.

‡ A male is mentioned by Piaget in his monograph, but there is no male in the collection.

Species.	No. of specimens in B.M.	No. of slides.	Hosts.
C. subpachygaster Piaget	5 ♀♀, 1 ♂.	3	*Strix passerina.* *Strix flammea.* *Strix noctua.*
C. subpenicillatum Piaget	3 ♀♀, 3 ♂♂.	4	*Ibis hagedasch.* *Ibis falcinella.*
C. sulcatum Piaget	1 ♀*.	1	*Sterna nigra.*
C. temporale Piaget	1 ♀.	1	*Macroglossus aterrimus.*
C. tibiale Piaget	5 ♀♀, 6 ♂♂.	5	*Tantalus senegalensis.* *Mycteria senegalensis.*
C. tricinctum Nitzsch	1 ♀, 1 ♂.	1	*Milvus ater.*
C. trimaculatum Piaget	5 ♀♀, 2 ♂♂.	4	*Platycercus palliceps.* *Platycercus barrabandi.*
C. trispinum Piaget	4 ♀♀, 3 ♂♂.	3	*Theristicus caudatus.*
C. trochioxum Nitzsch	3 ♀♀, 2 ♂♂.	2	*Ardea purpurea.* *Ardea stellaris.*
C. trochioxum var. *minor* Piaget.	6 ♀♀, 4 ♂♂.	4	*Ardea russata.*
C. truncatum Piaget	10 ♀♀, 7 ♂♂ †.	8	*Grus antiqua.* *Grus carunculata.* *Grus mexicana.*
C. umbrinum Nitzsch	1 ♂ ‡.	1	*Tringa subarquata.*
C. uniseriatum Piaget	3 ♀♀, 1 ♂.	3	*Recurvirostra avocetta.*
C. zebra Nitzsch	3 ♀♀, 2 ♂♂.	3	*Ciconia alba.*
Nitzschia burmeisteri Denny	2 ♀♀.	1	*Cypselus apus.*
N. pulicaris Nitzsch	3 ♀♀, 4 ♂♂, 4 imm.	5	*Cypselus apus.*
Trinoton conspurcatum Nitzsch	8 ♀♀, 5 ♂♂.	9	*Cygnus musicus.* *Cygnus atratus.*
T. continuum Piaget	4 ♀♀, 3 ♂♂, 3 imm.	5	" Oie domestique."
T. femoratum Piaget	1 ♀.	1	*Phœnicopterus antiquorum.*
T. lituratum Nitzsch	1 ♀.	1	*Dendrocygnus arboreus.*
T. lituratum var. *intermedium* § Piaget.	1 ♀.	1	*Anas rajad.*
T. luridum Nitzsch	9 ♀♀, 1 ♂.	6	*Anas clangula.* *Anas querquedula.* *Anas crecca.* *Anas acuta.* " Canard de Caroline."
T. spinosum Piaget	2 ♂♂ ‖.	2	*Mareca penelope.*
Eureum cimicoides Nitzsch	1 ♀.	1	*Cypselus apus.*
Læmobothrion emarginatum Piaget.	2 ♀♀.	1	*Gallinula hæmatopus* (Celebes).
L. giganteum Nitzsch	1 ♀, 1 ♂.	1	*Falco tinnunculus.*

---

* Only the male is mentioned in the original description, but the specimen in the collection is almost certainly a female.

† Also a slide, with two specimens, bearing two names on the label, i. e., *C. truncatum* P., ♂, and *C. thoracicum*, ♀, from *Grus antiqua.*

‡ Piaget mentions the female and specimens from other hosts in the monograph, but only a single male is contained in the collection.

§ This var. is treated as a distinct species by Piaget in his monograph.

‖ Females are mentioned in the original description, but there are none in the collection.

Species.	No. of specimens in B.M.	No. of slides.	Hosts.
L. ? hastipes Nitzsch	2 ♂♂.	1	*Falco tinnunculus.*
L. laticolle Nitzsch	6 ? imm.	2	*Falco subbuteo.*
L. pallidum Piaget	1 ♀ (in pieces).	1	*Ibis olivacea.*
L. setigerum Piaget	2 ♀♀, 2 ♂♂.	2	*Ibis cayennensis.*
L. titan Piaget	2 ♀♀.	2	*Milvus ætolius.* *Polyborus vulgaris.*
Physostomum agonum Nitzsch	1 ♀.	1	*Sylvia rubecula.*
P. fasciatum Piaget	1 ♀.	1	*Larus argentatus.*
P. intermedium Piaget	2 ♀♀, 1 ♂.	2	*Bombycilla garrula.*
P. longetarsatum Piaget	1 ♀.	1	"*Lamprotornis.*"
P. maculatum Piaget	1 ♀.	1	*Apternus crissoleucus.*
P. mystax Nitzsch	1 ♀, 1 ♂.	1	*Turdus pilaris.*
P. thoracicum Piaget	1 ♂.	1	*Centropus eurycercus.*

[To be continued.]

XXX.—*Trichoptera collected in Morocco by Messrs. K. H. Chapman and G. A. Bisset.* By Martin E. Mosely.

All the conditions of the various ranges of the Atlas Mountains would appear favourable for a rich and varied Trichopterous fauna, which, however, still remains comparatively unknown.

The collections brought home by Messrs. Chapman and Bisset are therefore of importance as well as of interest, since no fewer than seven new records are added to the somewhat meagre total, three of the seven being of species new to science.

In addition to these seven species the collections contain a long series of *Hydropsyche pellucidula*, a species which has already been recorded and is almost universally distributed throughout European regions, extending to the Mediterranean islands and even into Asia and Asia Minor.

A single example of *Mesophylax aspersus* was taken. This insect is new to the Moroccan list, and is generally regarded as a cave-dweller.

A single example also of *Tinodes waeneri* was taken, also a species with a very wide distribution, and two or three examples of *Leptocerus cinereus*, as widely known as the above-mentioned species.

Mention should also be made of a single *Hydropsyche ornatula*, which differs slightly from the British pattern but shows no particular differences from examples found on the continent, stretching into Asiatic Russia.

The new species include a *Hydropsyche*, a *Tinodes*, and a *Psychomyia*, the last-named having been taken in considerable numbers.

Limnophilidæ.

Mesophylax aspersus Ramb.

A single female of this species, often cave-dwelling, was taken. It bears the data Great Atlas Mts. ; Ijoukak, vi. 1936.

Leptoceridæ.

Leptocerus cinereus Curt.

Two or three examples, both male and female, were taken at Middle Atlas Mts. : Aguelman Sidi ou Mohammed, 6500 ft., ix. 1935 ; and Great Atlas Mts. : Timhadit, 5000 ft., ix. 1935.

Hydropsychidæ.

Hydropsyche pellucidula Curt.

Numerous examples of both sexes were taken at Great Atlas Mts. : Ijoukak, 3900 ft., vi. 1936 ; and Great Atlas Mts. : Amizmiz, 3250 ft., 30. v. 1936.

Hydropsyche ornatula McLachl.

A single male was taken at Middle Atlas Mts. : Meknes, vi. 1936.

It is rather paler than is usual in the British examples ; the penis is much dilated along the lower margin, and there are slight lateral dilatations, neither of which are found in the British insect. I have, however, seen similar examples, sent to me by Martynov from Russia. French examples also show some resemblance to the Moroccan form.

***Hydropsyche timha*, sp. n.** **(Figs. 1–3.)**

Wings yellowish grey, very broad at their apices, and with the usual *Hydropsyche* pattern ; eyes of the male normal in size, *Genitalia*, ♂.—The dorsal plate terminates in a pair of triangular lobes with an excision between; side-pieces of the ninth segment produced in rounded angles; penis from the side slightly dilated along its lower margin towards the apex, which is dilated on its upper margin; from above, the apex is excised, and there are lateral dilatations at the point where the lower margin is dilated;

Fig. 1. Fig. 2.

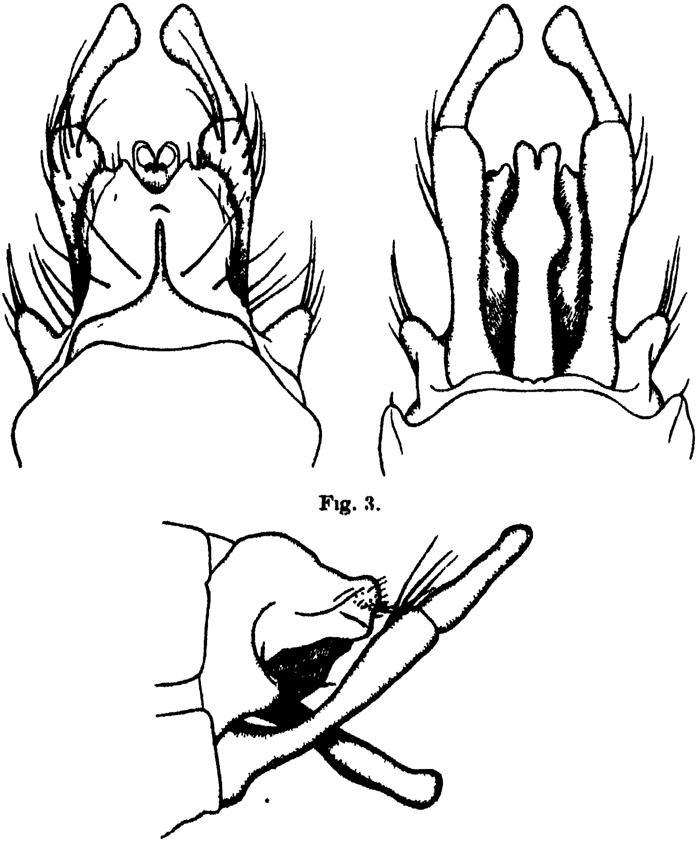


Fig. 3.

Hydropsyche timha, sp. n., ♂.

Fig. 1.—Genitalia, dorsal.
Fig. 2.—Ditto, ventral.
Fig. 3.—Ditto, lateral.

there are two little triangular processes at the apex on its upper surface; inferior appendages two-jointed, terminal joints from above, with the apices much dilated, margins obliquely truncate.

Middle Atlas Mts.: Timhadit, 5000 ft., ix. 1935, 4 ♂♂, 2 ♀♀; Oumer Rebia, 2000 ft., 26. v. 1934, 1 ♀.

Type, ♂, and paratypes, ♂ & ♀, in the collection of the British Museum.

Cheumatopsyche sp.

A single female species of this genus was taken at Great Atlas Mts.: Ijoukak, 3900 ft., vi. 1936.

I refrain from giving this insect a name, as it is not as yet possible to give intelligible descriptions in this genus from the female sex.

Psychomyidæ.

Tinodes waeneri L.

A single male was taken at Middle Atlas Mts.: Meknes, vi. 1936.

Tinodes maroccana, sp. n. (Figs. 4–7.)

The insect is pale yellowish or cream-colour; head and body ochraceous.

Genitalia, ♂.—The apical margin of the ninth segment broadly and triangularly produced; superior appendages long and slender, uniform in width both from above and from the side; upper penis-cover from above, furnished with two pairs of spines, divergent towards their apices, one behind the other; penis membranous, with a single spine at its apex; inferior appendages two-jointed and branched; basal joint very stout, with a long slender branch arising from its upper and inner margin near the base, directed distally; from above the apices of these branches are narrowed to acute points; the apex of the lower branch is excised, and set in the excision is a short, stout second joint with a slightly hooked inner margin at its apex, seen from beneath; from the side, there appears to be a ridge along the upper margin, produced at its distal end in a projecting lip; the lower part of the ninth segment is somewhat produced.

Great Atlas Mts.: Mouldirt, 5300 ft., 13. v. 1936; Ijoukak, 3900 ft., vi. 1936.

Fig. 5.

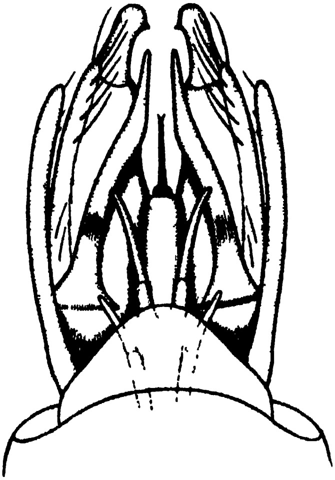


Fig. 4.

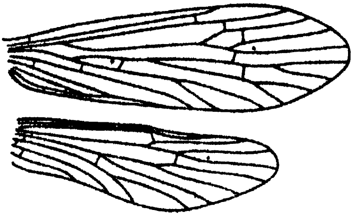


Fig. 6.

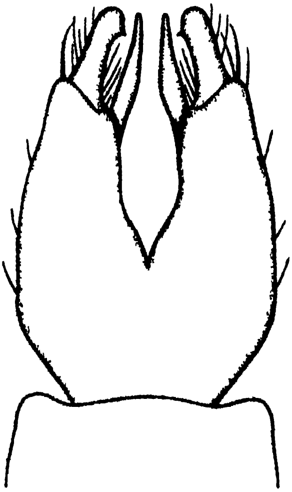
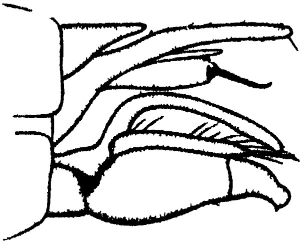


Fig. 7.



***Tinodes marocoana*, sp. n., ♂.**

Fig. 4.—Wings.
Fig. 5.—Genitalia, dorsal.
Fig. 6.—Ditto, ventral.
Fig. 7.—Ditto, lateral.

Type and paratypes, ♂, in the collection of the British Museum.

The species is allied to *Tinodes unicolor* Pict.

Psychomyia bifurcata, sp. n. (Figs. 8 & 9.)

Insects closely resembling *Psychomyia usitata* McLach.; differing very slightly in the neuration of the anterior wing and in the form of the inferior appendages.

In *usitata* the forks of the appendages are very slender, the outer being longer than the inner; in *bifurcata* the forks are broader, approximately of the same length or the inner slightly the longer; superior appendages with widened, blackened inner edges, as in *usitata*.

Fig. 8.

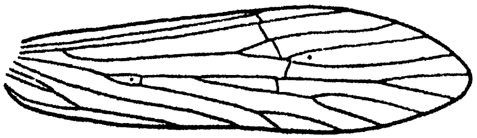
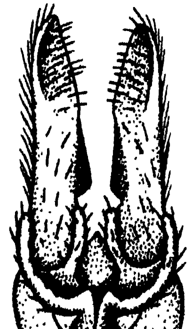


Fig. 9.



Psychomyia bifurcata, sp. n., ♂.
Fig. 8.—Wings.
Fig. 9.—Genitalia, ventral.

Length of anterior wing: ♂ 3·5 mm., ♀ 3 mm.

Middle Atlas Mts.: Timhadit, 5000 ft., ix. 1935; Great Atlas Mts.: Mouldirt, 5360 ft., 13. vi. 1936; Ijoukak, 3900 ft., vi. 1936 (*K. H. Chapman*).

Type, ♂, paratypes, ♂♂ and ♀♀, in the collection of the British Museum.

There are two ♂ paratypes in the Vienna Museum bearing labels "Andalusia, Algeciras, 12–20. v. 1925 (*Dr. Zerny* leg.); Middle Atlas Mts., Meknes, vi. 1936."

A List of Trichoptera recorded in Morocco.

(* Taken by Messrs. Chapman and Bisset; † new records.)

Limnophilidæ.

*†*Mesophylax aspersus* Ramb.
Stenophylax permistus McLachl.

Sericostomatidæ.

Schizopelex festiva Ramb.

Leptoceridæ.

*†*Leptocerus cinereus* Curt.
Adicella maura Navás.
Triaenodes alluaudi Navás.
Setodes acuta Navás.
—— *montana* Navás.

Hydropsychidæ.

**Hydropsyche pellucidula* Curt.
—— *fulvipes* Curt.
*†—— *ornatula* McLachl.
—— *maroccana* Navás.
—— *fezana* Navás.
—— *fenzana* Navás.
—— *mauri* Navás.
*†—— *timha*, sp. n.
Cheumatopsyche sp., ♀.

Psychomyidæ.

*†*Tinodes waeneri* L.
*†—— *maroccana*, sp. n.
*†*Psychomyia bifurcata*, sp. n.

Rhyacophilidæ.

Rhyacophila atlantica Navás.
—— *orema* Navás.

XXXI.—*Three new* Telenominæ. By G. E. J. Nixon, B.A., Imperial Institute of Entomology, British Museum (Natural History).

In the following short paper I am bringing forward an interesting new genus and also a new species of *Telenomus* (*Aholcus*), for which an early determination has been requested.

The types of the new species are in the British Museum.

Subfamily *Telenominæ*.

Nardo, gen. nov.

♂♀.—Antennæ of ♂ 12-segmented, of ♀ 11-segmented; funicle segments 5–9 in ♂ not transverse; antennal club in ♀ 3-segmented, funicle 6 being very distinctly nearer in size to 5 than to 7. Frons somewhat flattened, but, between the lower margin of the eye and the antennal insertions, bulging downwards, and producing a conformation of the head which results in the actual points of insertion of the antennæ together with the clypeus lying in a plane more or less at right angles to the greater surface of the frons; an approach to this condition is seen in *Platytelenomus*, as interpreted by me in *P. hylas* Nixon (1935), but the shape of the head is entirely different from what occurs in *Microphanurus*, *Telenomus*, and its subgenus *Aholcus*; in these three segregates the points of insertion of the antennæ, the clypeus, and the frons itself lie on the same even curve. Mandibles short, forming a more or less beak-like projection which is directed backwards and downwards.

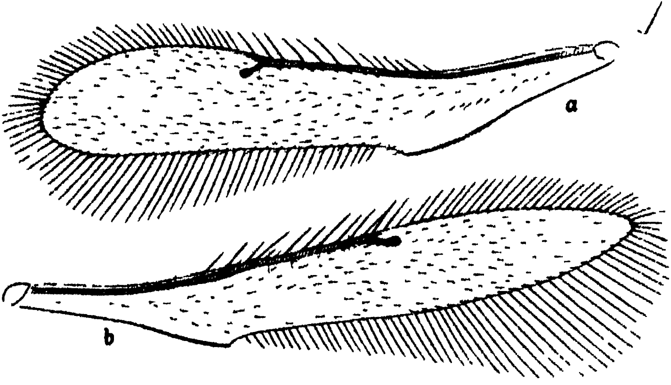
Thorax markedly flattened, in one species strongly so. Posterior dorso-lateral margins of the pronotum extending on to the dorsal surface of the thorax, where they are readily visible from above; in this respect *Nardo* differs from *Platytelenomus*, which it otherwise strongly resembles in the structure of the thorax. Mesonotum, scutellum, postscutellum, and the dorsal surface of the propodeum lying in the same plane. Scutellum strongly transverse. Postscutellum showing as a shining unsculptured band. Propodeum having a dorsal surface about as long as the scutellum and with a fine central groove. Fore wings very narrow, the fringe very long;

stigmalis very short; marginalis very long, about 4½ times as long as the stigmalis; hind wings exceedingly narrow, parallel-sided beyond the nervature, their fringe about 2½ times as long as their greatest width.

Abdomen very much flattened, at least twice as long as wide.

In referring this genus to Kieffer's monograph of the Telenominæ, it is necessary to compare it only with *Aradophagus* and *Platytelenomus*, on account of the flattened form which all three genera possess. On account of the venation *Nardo* is unlike *Platytelenomus* but like *Aradophagus*; the resemblance to the latter genus, however, ends here, for *Aradophagus* seems to be a very different looking insect and has 12-segmented antennæ in both sexes. The resemblances between *Nardo* and *Platytelenomus* have been touched on in the generic description of *Nardo*; a very determinate difference is to be found in the venation, which alone makes *Nardo* a distinct and very characteristic genus.

Fig. 1.



Fore wing of: (*a*) *Nardo cumæus*, sp. n.; (*b*) *Nardo phæax*, sp. n.

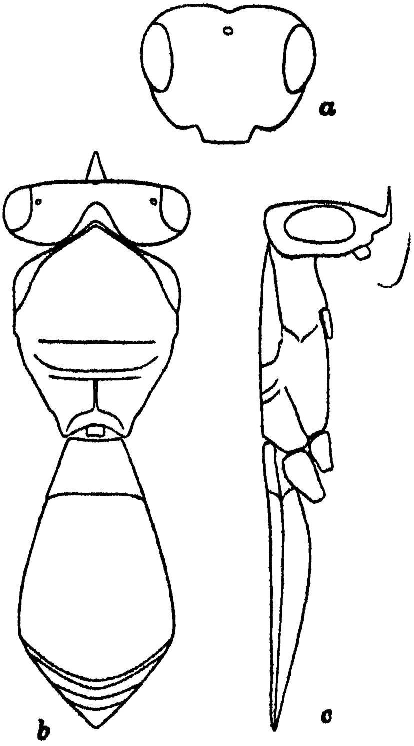
Type of the genus, *Nardo cumæus*, sp. n.

Nardo cumæus, sp. n. (Fig. 2, *b* & *c*.)

♀.—Legs entirely, antennæ except apical three segments (which are dark brown) pale honey-yellow. Abdomen yellowish over roughly its basal half, but brown elsewhere, the brown part being paler than the head and thorax.

Head, seen from the side, strongly flattened; seen from above, in such a way as it appears shortest, about 3½ times as wide as its greatest length; seen from in front, it is distinctly transverse (fig. 2, *a*). Frons almost everywhere smooth and shining. Face between the antennal insertions produced to form a sharply pointed triangular projection, which is strongly flattened. Antennæ (fig. 3, *c*). Vertex with some very fine sculpture. Clypeus feebly convex.

Fig. 2.

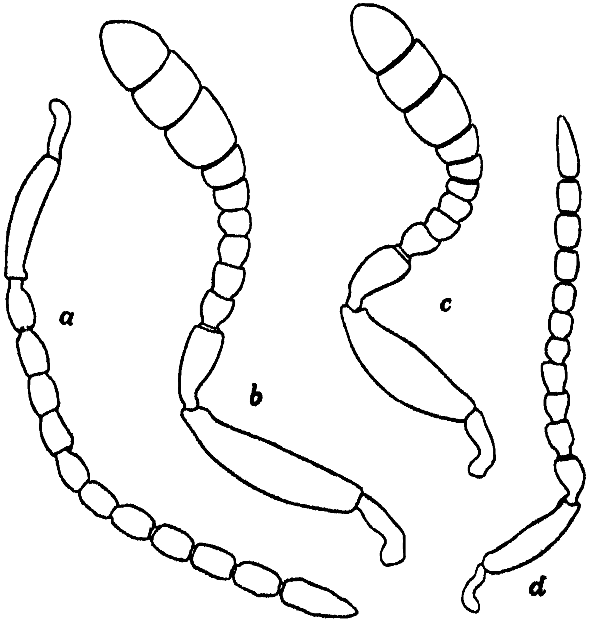


Nardo cumæus, sp. n.

(*a*) head of ♀, from in front; (*b*) body of ♀, dorsal; (*c*) body of ♀, lateral.

Thorax strongly flattened dorso-ventrally, all its dorsal sclerites lying in the same plane and being separated by fine sutures. Mesonotum smooth and shining more or less everywhere, angularly narrowed in front to fit into the notched vertex. Scutellum very short, smooth all over. Dorsal surface of the propodeum a little longer than the scutellum, virtually smooth everywhere. Fore wings (fig. 1, *a*).

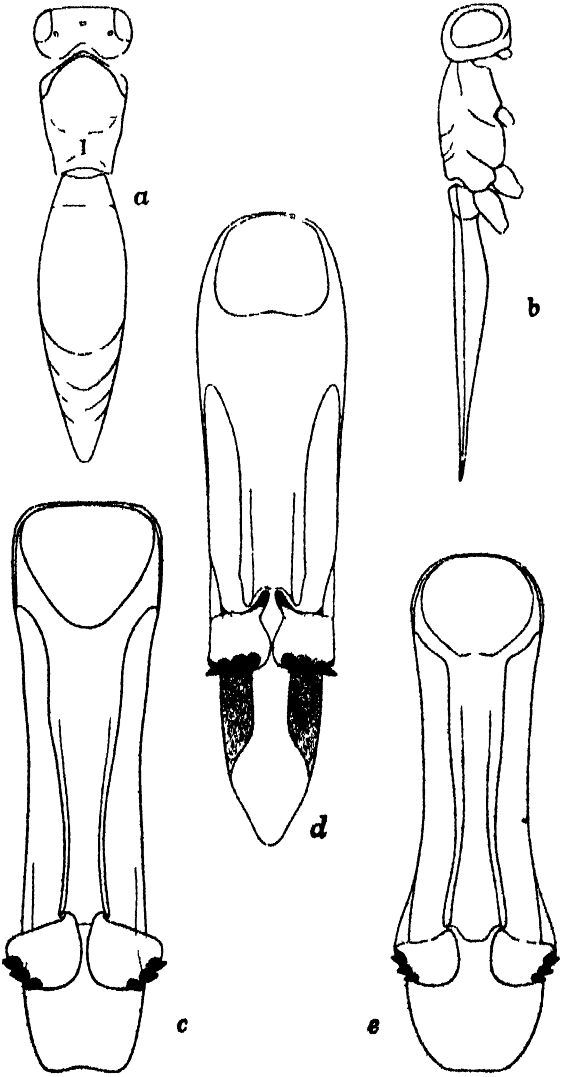
Fig. 3.



Nardo phæax, sp. n. (*a*) antenna of ♂ ; (*b*) antenna of ♀.
Nardo cumæus, sp. n. (c) antenna of ♀ ; (*d*) antenna of ♂.

Abdomen clearly widest beyond the middle, a little less than twice as long as its greatest width, about 7 : 4. The abdomen is very constant in shape and the relative positions of the tergites in the material examined. Tergite 1 twice as wide apically as its medial length, evenly striated all over ; 2 longer than wide, about 5 : 4, its apical margin rounded, evenly striated over about its basal half.

Fig. 4.



Nardo phæax, sp. n. (*a*) body of ♀, dorsal; (*b*) body of ♀, lateral; (*c*) genitalia of ♂.
Telenomus (*Aholcus*) *phegeus*, sp. n. (*d*) genitalia of ♂.
Nardo cumæus, sp. n. (*e*) genitalia of ♂.

♂.—No trace of a process between the antennal insertions as in the ♀. Antennæ shorter than in the following species; funicle segments 5–9 only a little longer than wide (fig. 3, *d*); in this respect the funicle approaches more closely than does that of the following species, the typical form of the antenna of male *Telenomus*. Genitalia (fig. 4, *e*).

Length, ♂♀, ·9 mm.

PUNJAB: Lyallpur (*R. Nath*); series containing both sexes, bred Sept. 1936 from eggs of the Hemipteron *Macropes excavatus* Distant.

Nardo phæax, sp. n. (Fig. 4, *a* & *b*.)

♀.—Black. Antennæ (except club, of which the segments are brown), legs and abdomen (except the extreme lateral margin of each tergite) pale honey-yellow. The abdomen tends to be a little richer in colour than the legs. The dark lateral margin of the tergites is brown.

Head seen from in front markedly transverse, with its upper and lower sides roughly parallel. Frons in greater part smooth and shining; on the downwards bulging surface between the lower inner surface of the eye and the antennal insertions there is some fine sculpture. Vertex deeply notched behind and with a fine medial cleft which reaches nearly to the anterior ocellus; surface of vertex finely and somewhat vaguely scaly-reticulate. Clypeus conically raised. Antennæ (fig. 3, *b*) arising from the lower side of the head owing to the peculiar formation of the frons; funicle 1–5 subequal.

Thorax somewhat flattened above, all its dorsal sclerites lying more or less in the same plane. Mesonotum narrowly angled in front, in far greater part, smooth and shining, but with some microscopic sculpture towards the sides. Scutellum unsculptured. Dorsal surface of the propodeum slightly shorter than the scutellum, smooth, except for some puncture-like depressions along its posterior margin; the central groove is very fine. Fore wings (fig. 1, *b*).

Abdomen variable in length according to the degree in which the tergites are exserted; in the (probable) normal condition it is about 2¾ times as long as its greatest width, about 11 : 4; in individuals in which the tergites are much exserted it can be fully four times as long as its greatest width. Tergite 2 with some fine striations at its extreme base. Ovipositor clearly visible through the pale integument of the abdomen.

♂.—Antennæ (fig. 3, *a*): funicle 5–9 subequal in length, very distinctly longer than wide. Genitalia (fig. 4, *c*).

Length, ♂, ·9 mm.; ♀, 1–1·1 mm.

PUNJAB: Lyallpur (*R. Nath*); series containing both sexes, bred Sept. 1936 from eggs of the Hemipteron *Macropes excavatus* Distant.

This and the preceding species are widely different from each other in the female sex, but less so in the male. The shape of the head will readily distinguish the latter.

TELENOMUS (AHOLCUS).

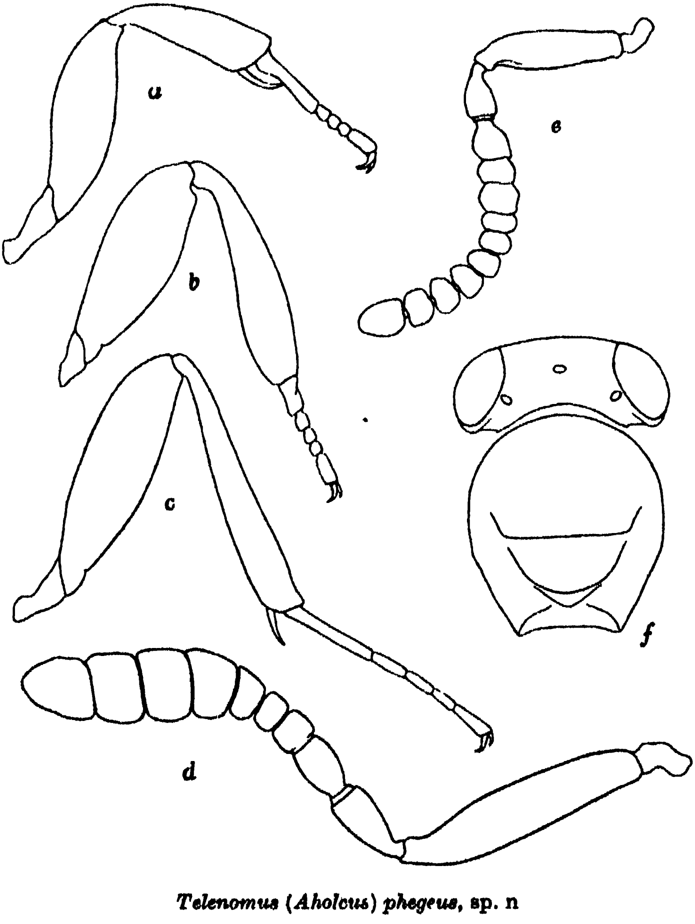
Telenomus (*Aholcus*) *phegeus*, sp. n.

♀.—Black. Antennæ virtually black throughout. Legs: femora black; tibiæ and tarsi brownish, the former sometimes suffused with darker colouring.

Head a little wider than the thorax, about 5 : 4 (fig. 5, *f*). Frons, as is usual within the genus, smooth and shining over most of its surface; along the inner eye-margin the smooth surface is interspersed with small, sharp, widely separated, setiferous punctures. Between the lower inner side of the eye and the antennal insertions the surface has a fine vague sculpture which shows a more or less transverse tendency. Eyes occupying virtually the entire lateral surface of the head, the head behind them being cut away almost at right angles to the long axis of the body. Shortest distance between the eyes slightly greater than their width as measured from above, 6 : 5. Antennæ (fig. 5, *d*): funicle 1 nearly twice as long as 2; 2 not longer than wide; club distinctly 4-segmented. Vertex rather sharply angled between the ocelli, its surface between them with the usual vague, more or less scaly-reticulate sculpture. Occipital margin lying well below level of vertex, so that the latter has a well-developed declivous surface.

Thorax: mesonotum evenly and rather strongly convex, feebly shining, its sculpture weak and indefinite and with no clear indication of fine punctures (×40); on its posterior third it is considerably more shining and almost smooth. Scutellum, as is usual within the genus, entirely smooth. Postscutellum with a central rugose swelling. Fore wings: venation blackish, sharply defined throughout; fringe at widest part of hind wing almost exactly half as long as the width of the wing there. Legs: basal segment of middle tarsus only about 2½ times as long as wide; in all the other African species I have described

Fig. 5.



Telenomus (*Aholcus*) *phegeus*, sp. n

(*a*, *b*, *c*) front, middle, hind leg respectively of ♂; (*d*) antenna of ♀; (*e*) antenna of ♂; (*f*) head and thorax, dorsal, of ♀.

except *anates* (1937) this segment is about four times as long as wide.

Abdomen distinctly longer than wide. Tergite 2 as long as wide and with a costate furrow at base.

♂.—Unlike the ♀ in that the femora, especially the middle ones, are very much swollen (fig. 5, *a*, *b*, *c*); the middle tarsi, too, are very short. Antennæ (fig. 5, *e*). Genitalia (fig. 4, *d*) distinctive and unlike that of any other species I have described either from Africa or Asia.

Length, ♂♀, ·9 mm. approx.

S. Africa: E. Transvaal (Vossman's Beacon) (*F. G. C. Tooke*); series containing many females and one male, bred, 28. iv. 1937, from cluster of Hemipterous eggs on leaf. Those eggs are bright metallic blue in colour, more or less spherical, except where their surface is widely flattened against the leaf, shallowly reticulate all over, and very shining.

On account of the form of the antennæ and the position of the occipital carina the female of this species could be confused possibly with *brimo* Nixon (1935). However, besides being a larger species the basal segment of the middle tarsus is shorter—it is, in fact, characteristically short—and the hind wing is broader in comparison with its fringe. Further, the vertex of *brimo* ♀ is less sharply angled between the ocelli, and hence the head is less sharply cut away behind the eyes than in *phegeus*.

T. (*Aholcus*) *phegeus* bears also a strong superficial resemblance to *T.* (*A.*) *incommodus* Nixon (1937), a Malayan species, having, among other points in common, a head of similar shape though less wide in proportion to the width of the thorax than in the latter insect.

The genitalia of the male of *phegeus* is widely different from that of *incommodus*—the two species belong to different species-groups—but much less so from that of the male of *brimo*. But the male of *brimo* has the femora of ordinary form, with the middle tarsus longer, and altogether lacks the somewhat exaggerated sexual dimorphism of *phegeus*.

Somewhat characteristic of *phegeus* is the smoothness and shininess of the posterior part of the mesonotum.

XXXII.—Gammarus marinus *Leach, var. nov.* stoerensis (*Crustacea, Amphipoda*).

By D. M. Reid, Department of Biology, Harrow School.

The specimens to be described are most probably a variety of *G. marinus.* They cannot as yet be described as a separate species, because there have been only ten individuals collected so far and because of the well-known variability of this species. The different varieties, however, appear to be associated with environmental differences. For example, individuals of *G. marinus* which occur on sandy or coarser media tend to have spines and no setæ on the third uropod (outer ramus). Those which occur under stones lying on soft mud usually have setæ on the third uropod.

Both Chevreux et Fage (1) and Sars (2) figure the typical *G. marinus* with setæ on the inner edge of that appendage, yet the specimens in my collection seem to show that the spinous type without setæ is the commoner.

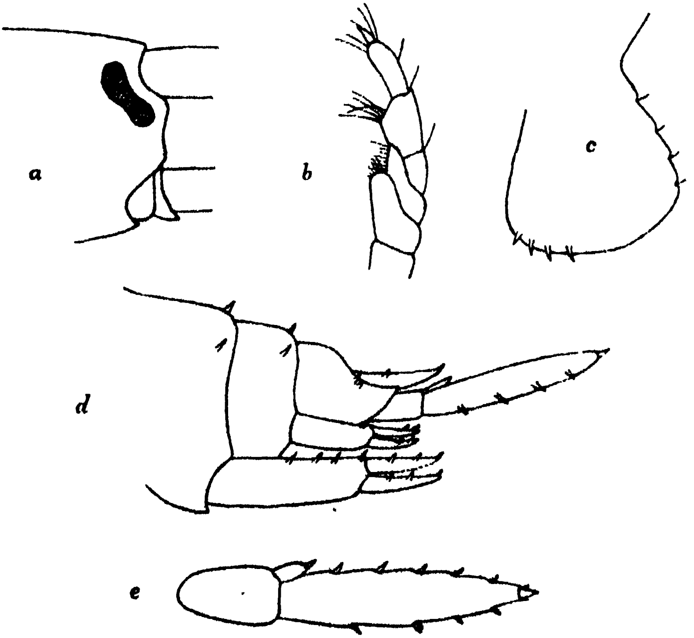
The variations encountered in *G. marinus* are usually associated with one or two appendages only. In the present case, however, the whole animal is affected. It is little more than half the size of the type, which, with the shortness of the antennæ, gives the impression that it is a juvenile form. The females being ovigerous shows that it is adult.

The third epimeral plate is rounded posteriorly (like that of *G. rhipidiophorus* Catta), instead of being typically produced, thus distinguishing it at once from all other British species of *Gammarus.*

General Description.

Length 8 mm. Female ovigerous, April, 28 eggs.

Urosome segments 4-spined. Lateral head-lobes very slightly concave. Coxal plates 1–4 with a few spines on the posterior border of each : crenelated. Epimeral plate 1, posterior angle rounded, 2 and 3 not produced; posterior border of epimeral plate 3 with 4 small notches, 4 spines on antero-ventral border. Eyes normal. Antenna 1 less than half the body-length. First articulation of peduncle of antenna 1 less than 2 and 3. Flagellum with 18 articulations. Accessory flagellum with 4 articulations. Antenna 2, flagellum slightly shorter than 1, 12 articulations. Articulations 4 and 5 of the peduncle almost equal. Mouth-appendages normal. except that articulation 2 of palp of maxilliped has a group of long setæ on the inner border. Posterior border of first articulation of last peræopod crenelated and bearing a few setæ. Uropod 1 just passes 2. Uropod 3 long, external branch broad, more than twice the length of the peduncle. Setæ absent, but 4–5 groups of spines present on each margin. Inner branch short and broad. Telson divided to base, 1 lateral spine and 5 distal on each half. Telson passes peduncle of uropod 3.



Gammarus marinus var. *stoerensis*, nov.
a. Head. *b*. Maxilliped. *c*. Epimeral plate 3.
d. Urosome. *e*. Uropod 3.

Habitat.

So far the only locality in which I have found this variety is on the south side of Stoer Bay on the west coast of Sutherland. The animals were living under stones in very shallow pools and under stones lying on coarse sand just above the low-water mark of ordinary spring tides. The habitat, indeed, is very similar to that of *G. marinus*.

I have to thank Dr. K. Stephensen of Copenhagen for having looked over the material and for his advice.

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(1) CHEVREUX, ED., & L. FAGE. 1925. 'Faune de France.—IX. Amphipodes.' Paris.
(2) SARS, G. O. 1890–5. 'Crustacea of Norway,' vol. i., Amphipoda. Christiania.

XXXIII.—*Some new African Neuroptera and Mecoptera.*

By D. E. KIMMINS, Department of Entomology, British Museum (Natural History).

NEUROPTERA.

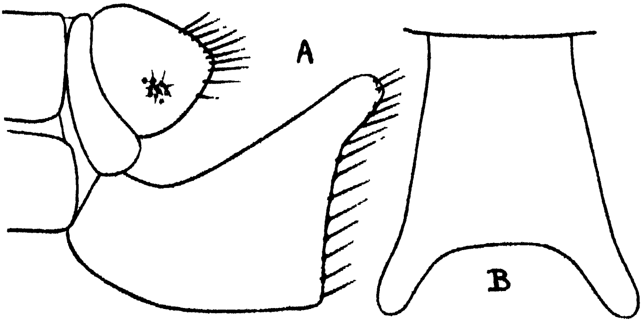
Family **Nemopteridæ**.

Nemopistha juju, sp. n.

♂.—Resembling *N. imperatrix* Westwood in its small pterostigma.

Rostrum luteous, fuscous at apex; palpi luteous. Eyes large, globose, separated on the vertex by a space less than the diameter of the basal segment of the antenna. Vertex pale fuscous, towards the antennal sockets with a feeble median carina. Antennæ slender, about as long as anterior wing, fuscous, paler towards the base, where the segments are annulated apically, and marked ventrally with luteous. Pronotum pale fuscous, with luteous lateral margins, much constricted anteriorly (possibly accidental), fringed with slender setæ, pale on posterior, black on lateral margins. Meso- and metanota fuscous, with obscure luteous markings, and clothed with sparse, pale, somewhat flattened hairs. Thorax ventrally luteous, with a few small fuscous spots. Legs luteous, marked with pale fuscous:—a streak on each trochanter, a dorsal basal spot and the apical fourth of each femur, and an equal length at the base of each tibia. Bristles and spurs dark fuscous, tarsal claws reddish brown. Abdomen with the basal halves of tergites 3–8 fuscous, apices luteous, 9 fuscous; sternites and anal plates luteous, 1 and 2 with a median fuscous streak. Tergite 1 luteous, with a narrow median line, the apical third fuscous. Tergite 2 luteous, with a fuscous, elongate, basal triangle. Anal plates roughly triangular, apical angles rounded, armed with stout black setæ. On the lower half of each plate is a group of minute trichobothria. Ninth sternite about twice as long as the ninth tergite and anal plates combined; in lateral view dilating to a truncate apex, the upper angle of which is produced in a short finger. Apical margin of sternite armed with strong black setæ, arising from elevated bases. The internal genital structures do not appear to offer any distinctive specific characters.

Fig. 1.



Nemopistha juju, sp. n., ♂.
A, apex of abdomen, lateral; B, ninth sternite, ventral.

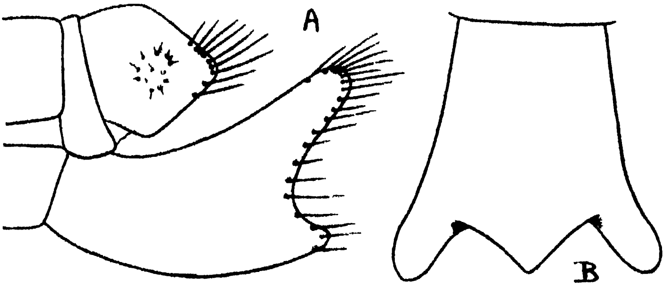
Anterior wing elongate, pointed, with the actual apex rounded, margin below the apex straight or slightly convex. Main longitudinal veins luteous, with fuscous spots at the junctions with the cross-veins. Secondary venation and cross-veins fuscous. Cross-veins between the medius and upper branch of Cu_1, and lower branch of Cu_1 and Cu_2 bordered with fuscous. Pterostigma fuscous, small, occupying only the posterior half of one costal cell. Posterior wing 2½ times as long as anterior, apex dilated in the usual ribbon at apex. Marginal veins luteous, becoming darker apically, longitudinal veins pale fuscous, cross-veins brown. Apical ribbon dark brown in its basal half, apex opaque white.

Anterior wing, length 31 mm., width 10 mm.; posterior wing, length 74 mm.

Type ♂, N. Nigeria, Jebba, Ju-ju Rock, in recess in cave (*E. D. Morel*), in the British Museum collection.

This species is (in the male sex) very distinctive by reason of the large eyes and consequent narrow vertex. The pronotum also appears to be narrower than usual, although this may be accidental. *N. imperatrix* Westwood may be distinguished from *N. juju* by its darker legs, unbanded abdomen, creamy yellow apices of the hind wings, and the produced central margin of the ninth sternite (fig. 2).

Fig. 2.



Nemopistha imperatrix (Westwood), ♂.
A, apex of abdomen, lateral; B, ninth sternite, ventral.

Nemopistha cognata, sp. n.

♂.—Similar in general coloration to *N. juju*, rather darker. Rostrum luteous, fuscous towards apex; suture between it and gena brownish; palpi fuscous. Vertex pale fuscous, with a weak median carina towards the antennal sockets. Eyes not unusually large, separated on the vertex by a space more than the diameter of the basal segment of the antenna. Antennæ similarly but more strongly marked than in *N. juju*. Pronotum discoloured, not strongly constricted anteriorly, apical angles rounded, clothing obscured. Meso- and metanota dark fuscous, with luteous markings above the anterior wing bases, on the mesoscutellum, and the metascutum. Sides luteous, with fuscous marks on the supraepisterna.

Legs luteous, marked as in *N. juju*, with the addition of a narrow fuscous line on the anterior and posterior surfaces of the femora. Abdomen discoloured, more strongly marked than in *N. juju*, but with a similar pattern. Shape of ninth sternite as in the preceding species.

Anterior wings much as in *N. juju*; area between *M* and upper branch of Cu_1, and that between the lower branch of Cu_1 and Cu_2, rather wider. Posterior wing with the dilated apex rather wider in proportion to its length, brown area paler, apex creamy, not white.

Anterior wing, length 34 mm., width 11 mm.; posterior wing, length 77 mm.

♀.—Resembling the male, but having a wider space on the vertex between the eyes (more than twice the diameter of the basal antennal segment). Pronotum shaped as in the male, fuscous, with a paler median line and luteous side margins; clothing consisting of sparse short black setæ. Meso- and metanota marked as in male, but clothed with sparse short black setæ, no pale hairs. Abdomen shorter than in male, with similar luteous and fuscous markings. Ninth tergite short, divided dorsally. Ninth sternite in the form of a pair of latero-ventral reniform lobes, set with black setæ. Tenth tergite represented by a pair of triangular lateral plates, with rounded apices, set with black bristles and each carrying a group of small trichobothria.

Anterior wing a little broader and more rounded than in the male.

Anterior wing, length 35 mm., width 11·5 mm.; posterior wing, length 78 mm.

Type ♂, S. Nigeria, Ilesha, 4. xi. (*Capt. Blair*); paratype ♀, Nigeria, Jos, 4000 ft. (*Gregsam Williams*), both in the British Museum collections.

This species closely resembles the preceding one, and I should have hesitated to separate them were it not for the striking difference afforded by the size of the eyes in the respective males. As in the previous species, the colour of the legs and the form of the ninth sternite should separate it from *N. imperatrix* Westwood, to which it is related by the small pterostigma. In the form of the male ninth sternite both these Nigerian species recall *Nemopistha regina* Navás, but this is described and figured as having a large pterostigma.

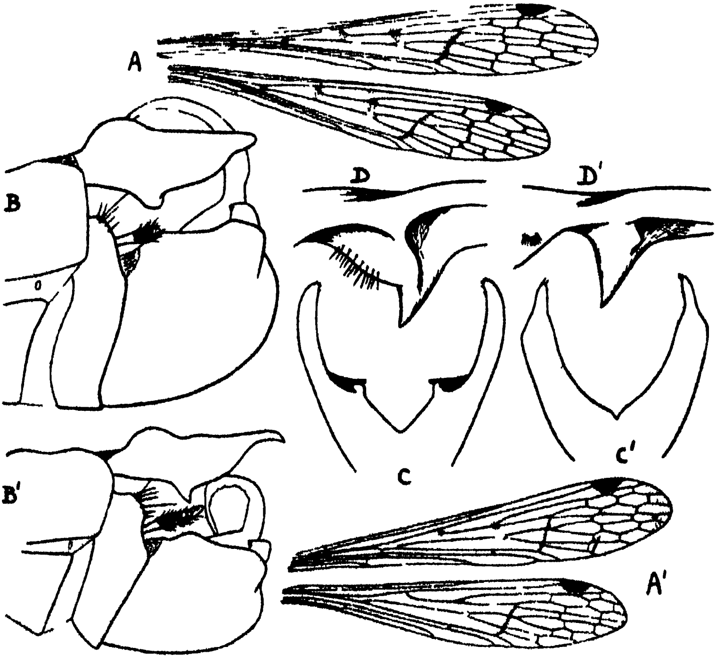
MECOPTERA.

Family **Bittacidæ.**

Bittacus peterseni, sp. n.

♂.—Similar to *B. selysi*, but larger, and with narrower wings. Cross-vein between *Sc* and *R* close to origin of *Rs* in both wings. Pterostigma more elongate. Claspers of the ninth tergite, seen from the side, stouter, less acute at the apices, and with a rounded (not acute) projection. Seen obliquely from above and within this projection appears as a stout tooth directed inward, with a fringed

Fig. 3.



Bittacus peterseni, sp. n., ♂ (A–D) and *B. selysi* E.-P., ♂, (A'–D').

A, A'. Wings.
B, B'. Genitalia from side.
C, C'. Claspers of ninth tergite from above.
D, D'. Tooth of clasper (more enlarged) obliquely from above and within.

ridge on its basal side (in *selysi* this ridge is replaced by a small hairy wart, separated from the tooth). In dorsal aspect the claspers are divergent, stout as far as the tooth, then narrow and slightly incurved to their apices, which bear five or six short black spines. (In *selysi* the claspers are stout for the greater part of their length, only the apices being narrow; ventral tooth not, or scarcely, visible from above.) Cerci short, slightly dilated apically (tapering in *selysi*). Gonopods much as in *selysi*.

Length of anterior wing 24 mm.; of posterior wing 21·5 mm.

Type ♂, Cape Colony, East London, Chuda River, 4. xi. 23 (*H. K. Monro*), ser. no. 1391. Presented to the British Museum by the Imperial Institute of Entomology, 1928.

XXXIV.—*New African Species of* Elattoneura (*Odonata*).

By D. E. Kimmins, Department of Entomology, British Museum (Natural History).

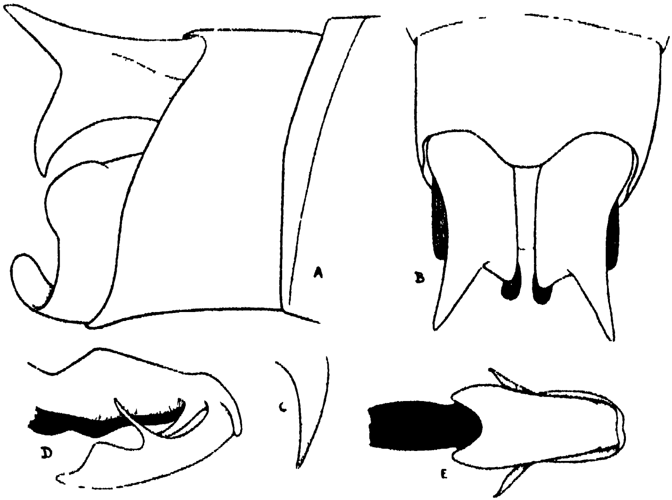
Elattoneura pruinosa (Selys). (Figs. 1 & 2.)

Disparoneura pruinosa Selys, 1886 (partim), Mem. Cour. xxxviii. pp. 166–7.
Elattoneura pruinosa Cowley, 1936, Ann. & Mag. Nat. Hist. (10) xvii. p. 518.

Whilst preparing to incorporate a series of this species taken in S. Cameroons, it appeared to me that the examples already in the National Collection (from Sierra Leone) had a slightly different facies, and out of curiosity I made a careful comparison of them with the S. Cameroons examples. Differences in the anal appendages were revealed, and as Selys' description agreed reasonably with both forms, I sent sketches of them to Monsieur A. Ball, of the Brussels Muesum, asking him to compare them with the type, and whether both forms were present in Selys' series. He replied that *D. pruinosa* Selys was represented by two males, and that the example bearing the author's label had the down-turned tooth of the superior appendage simple and acute at its apex (as in our S. Cameroons specimens), and that its locality was Cameroons. The other example (labelled "Camur. Ruth.") had this tooth bifid at its apex, and agreed with our specimens from Sierra Leone.

At his suggestion, therefore, I am selecting as holotype of *Disparoneura pruinosa* Selys the male with the author's determination label, and bearing a Cameroons locality label, written on blue paper. The remainder of the

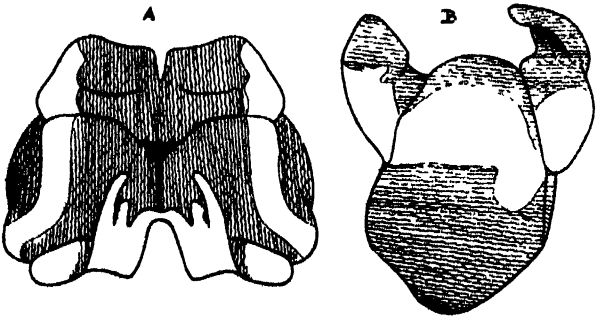
Fig. 1.



Elattoneura pruinosa (Selys), ♂.

A, apex of abdomen from side ; B, the same from above ; C, apex of ventral tooth of superior appendage from behind ; D, penis, lateral ; E, penis, ventral.

Fig. 2.



Elattoneura pruinosa (Selys), ♀.

A, prothorax from above ; B, the same, left lateral.

type-series, including the female, of *D. pruinosa* Selys are presumably in the McLachlan collection, and their identity must for the present remain uncertain.

It appears probable, however, that the female described by Selys really pertains to the following species (*E. balli*, sp. n.), as amongst a long series of male *E. pruinosa* from Cameroons (in the collection of Mr. J. Cowley) there is a single female which differs decidedly in form of the posterior lobe of the prothorax from that described by Selys. The margin of this lobe (fig. 2) is curved upwards and produced in two paired black fingers, the outer and longer directed towards the head, and the inner obliquely upwards and inwards. The anterior margin of the prothorax has at its centre a deep narrow excision. Prothorax black, with a pair of yellow lateral stripes.

Elattoneura balli, sp. n. (Fig. 3.)

Disparoneura pruinosa Selys, 1886 (partim), Mem. Cour. xxxviii, pp. 166–7 ("Camur. Ruth.").

♂.—Very similar in general appearance to *E. pruinosa* (Selys), and scarcely to be distinguished from it by Selys' description. The differences are:—Apices of wings slightly more pointed; dorsum of abdominal segment 2 with a fine longitudinal pale line; base of segment 3 sometimes with a pale yellow rounded spot on each side; downcurved tooth arising from the inner margin of superior appendage bifid at its apex (simple and acute in *pruinosa*). The most striking difference, however, is in the form of the penis, which will be better appreciated by reference to the comparative figures of the two species.

Length of anterior wing 23 mm.; of posterior wing 21 mm.; of abdomen 34 mm.

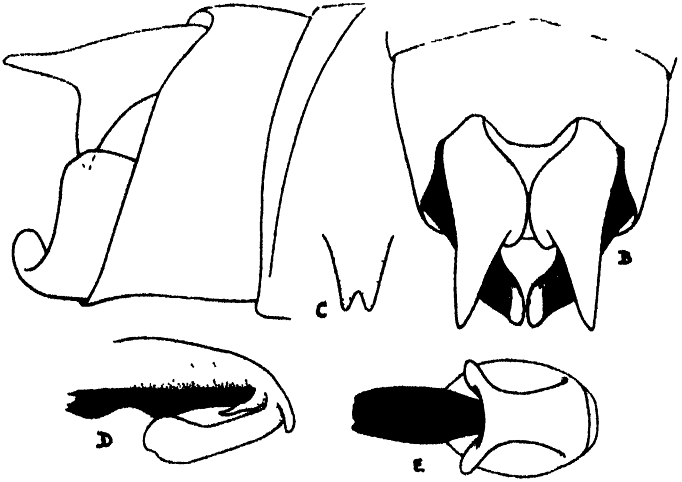
Type ♂, Sierra Leone, Bafodea, 13. iv. 1912 (*Jas. J. Simpson*). Presented by Imperial Bureau of Entomology, 1921. Paratype ♂, Sierra Leone, 1835 (*Morgan*), in the British Museum.

Paratype ♂, "Camur. Ruth.," in the Selys Collection, Musée Royal d'Histoire Naturelle, Brussels.

It is with pleasure that I name this species after Monsieur Antoine Ball, in recognition of the assistance he has given me on many occasions in elucidating difficult points in connection with the Selysian types of Odonata.

There is also in the British Museum a female *Elattoneura* from Sierra Leone which may possibly belong here. The posterior lobe of the prothorax conforms reasonably with that described by Selys as the female of *pruinosa*, which I have already suggested is the female of *E. balli*. In the absence of positive evidence of their specific identity I am labelling the Sierra Leone example *Elattoneura ? balli*, ♀.

Fig. 3.



Elattoneura balli, sp. n., ♂.

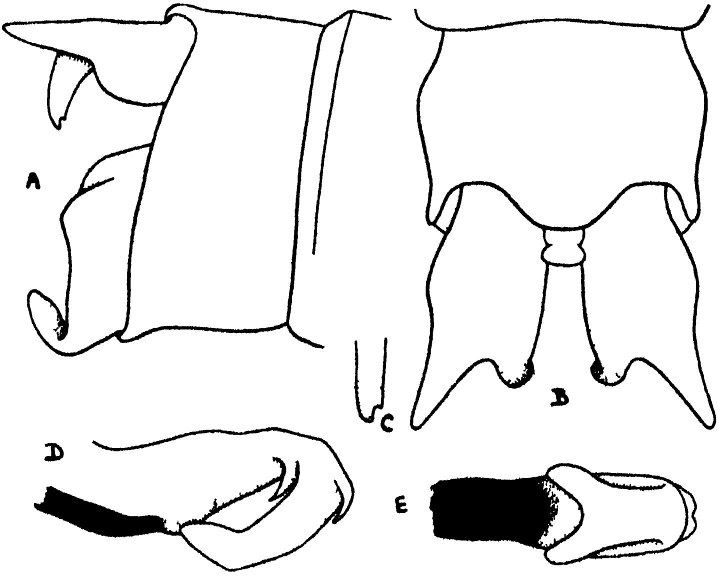
A, apex of abdomen, right lateral; B, the same, dorsal; C, apex of tooth of superior appendage from behind; D, penis, lateral; E, penis, ventral.

Elattoneura nigra, sp. n. (Fig. 4.)

Disparoneura frenulata Ris (*nec* Hagen), 1912, Sitzb. Akad. Wiss. Wien, cxxi. (1) pp. 160–162, figs. 8–9.

♂.—General colour black, slightly pruinosed. Labrum and genæ shiny, remainder of head mat black, before the ocelli somewhat pruinescent. Occiput with an obscure narrow pale streak. Prothorax mat black, slightly pruinescent. Pterothorax with a pair of narrow pruinescent antehumeral stripes, slightly narrower than their distance from the median carina. Small pale streaks on the metathoracic episterna and epimera. Anterior legs black, pruinosed, with black setæ. Median and posterior legs missing. Abdomen with obscure yellowish markings on the sides of segments 1–2; segments 3–6 with a fine median dorsal pale line. a pair of basal lateral bluish spots and a pair of subapical pale spots. 7 with basal spots only, 8–10 without spots. Superior appendage from the side, broad at its base, abruptly narrowed about midway. and tapering to an acute apex. Inner margin produced downward in a slender tooth, whose apex is bifid or notched. Inferior appendage of the usual pattern. Penis with internal and terminal folds present; segment 3 bilobed at its apex, the lobes divergent, and separated by a deep rounded excision.

Fig. 4.



Elattoneura nigra, sp. n., ♂.
A, apex of abdomen, right lateral; B, the same, dorsal; C, apex of tooth of superior appendage from behind; D, penis, lateral; E, penis, ventral.

Wings slender, postnodals 12 in anterior and 10 in posterior. Superior sector of triangle terminating between the second and third cross-veins beyond the nodus in both wings. Pterostigma black, posterior margin slightly shorter than the cell beneath it.

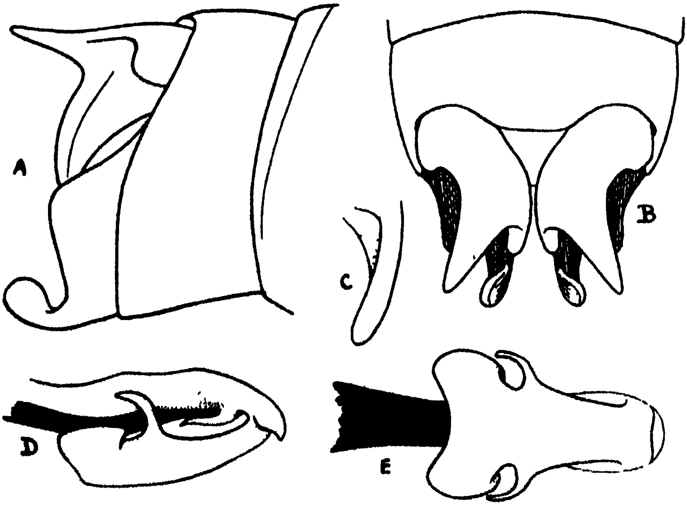
Length of anterior wing 17 mm.; of posterior wing 16 mm.; of abdomen 26 mm.

Type ♂, S. Nigeria, Ibadan, 11. iii. 19; paratype ♂, Kamerun, Buar, 10–29. v. 14; in the collection of the British Museum. Paratype ♂, Uganda, Mongalla, 9. iii. 05 (Dr. F. Werner Exp.), in the collection of the Vienna Mus., *Disparoneura frenulata* Hag. det. Dr. F. Ris.

The form of the appendages and penis of this species appear to indicate a relationship with *E. balli* m.

I am indebted to Dr. H. Zerny and Dr. Douglas St. Quentin, of Vienna, for the opportunity of examining the example from Uganda collected by the Werner Expedition.

Fig. 5.



Elattoneura dorsalis, sp. n., ♂.

A, apex of abdomen, right lateral; B, the same, dorsal; C, tooth of superior appendage from behind; D, penis, lateral; E, penis, ventral.

Elattoneura dorsalis, sp. n. (Fig. 5.)

♂.—Head black, with a pale yellow transverse band on each side between the eyes and the epistoma; a brownish spot outside each lateral ocellus. Prothorax black, with a narrow yellowish longitudinal band on each side. Posterior lobe broadly rounded. Pterothorax black, dorsally with a pair of pale yellowish spots covering the anterior two-thirds, from the humeral suture to the black median carina. Sides yellowish, with a black band covering the anterior half of the mesepimerum and its infraepisternum, and another along the second lateral suture. Legs blackish brown. Abdomen blackish, moderately slender, sides of segments 1–2 and base of 3 yellowish. Appendages black. Superiors rather longer than tenth segment, apices divergent and pointed, outer margins deeply excised, inner produced downward in a strong tooth, apex not bifid. Inferiors from the side short and broad, lower angles produced in short, upcurved, slightly dilated fingers. Penis with internal and terminal folds present, the latter short; segment 3 four-lobed, terminal pair divergent, broad, rounded, basal pair slender, curved.

Wings slender. Fourteen postnodals in anterior and twelve in posterior wings. Superior sector of the triangle terminating between the first and second cross-veins after the nodus in anterior wing, beyond the second cross-vein in posterior. Inferior sector of triangle arising from hind margin at a greater distance from the basal postcostal than the length of this cross-vein. Pterostigma reddish black, rhomboidal, small, surmounting one cell.

Length of anterior wing 20 mm.; of posterior wing 19 mm.; of abdomen 30 mm.

Type ♂, Sierra Leone, Yana, 30. iii. 1912 (*Jas. J. Simpson*). Paratype ♂, Sierra Leone, Kamakoni, 21. iv. 1912 (*Jas. J. Simpson*); in the British Museum, presented by the Imperial Bureau of Entomology, 1921.

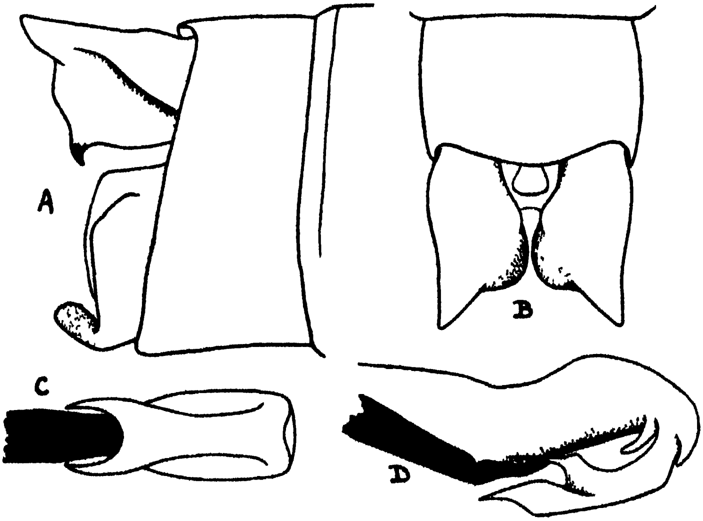
Elattoneura acuta, sp. n. (Fig. 6.)

Resembling *E. frenulata* Hagen, but differing in the form of the penis and anal appendages.

♂ (teneral).—Head dark brown, with the labrum, clypeus, genæ, a transverse band between the eyes, embracing the median ocellus, yellow-brown. Prothorax brown, with yellowish median and lateral bands. Thorax brown above as far as the first lateral suture, with a pair of yellowish antehumeral bands. Sides yellowish, with a brown band along the second lateral suture.

Legs yellowish, with dark brown setæ. Abdomen brown, marked with yellowish as follows. - Segment 2, a median dorsal patch; 3–7, a fine median dorsal line, a narrow basal and a wider subapical ring; 9 with a small dorsal subapical spot; apical portion of 10, above. Superior appendages pale, pointed, the inner margin of each produced downwards in a broad flap, the lower apical angle of which terminates in a small blackish hook. From above the appendages are stout, with rather divergent apices. Inferior appendages of the usual *Elattoneura* pattern, pale, with brownish apices. (In the type the appendages had become rather distorted in drying, and I therefore removed the apex of the abdomen and treated it with KOH. The figures and description have been drawn up from the preparation in fluid before mounting in Canada balsam.) Penis very similar to that of *E. frenulata* (Hagen), but the lobes of the terminal segment are more slender and acute,

Fig. 6.



Elattoneura acuta, sp n., ♂.
A, apex of abdomen, right lateral; B, the same, dorsal; C, penis, lateral; D, penis, ventral.

Wings slender, fourteen postnodals in anterior and thirteen in posterior wings. Superior sector of the triangle terminating just beyond the second cell after the nodus in the anterior wing, and beyond the third cell in the hind wing. Pterostigma brownish, finely encircled with pale yellow-brown.

Length of anterior wing 19 mm.; of posterior wing 18 mm.; of abdomen 30 mm.

Type ♂, Nigeria, Lagos (*G. Strachan*) in the collection of the British Museum.

This species differs from *E. mutata* (Selys) in the form of the penis and in the presence of only one tooth on the downturned margin of the superior appendage.

From *E. frenulata* (Hagen) it differs in the form of the penis (as detailed above) and in the much less pronounced tooth of the superior appendage, seen from the side. Teneral examples of both *mutata* and *frenulata* appear to have a much greater extent of pale colouring on the abdominal segments, of which 3–6 have only the apices dark brown.

XXXV.—*A new Moroccan Ephemeropteron*. By D. E. KIMMINS, Department of Entomology, British Museum (Natural History).

[Plate X.]

Baëtis maurus, sp. n.

Adult ♂ (preserved in formalin).—Turbinate eyes light yellowish red; lower eyes dark greenish black. Antennæ olivaceous. Notum of thorax shining piceous. Dorsum of abdominal segments 2–8 fuscous, with a pair of obscure, darker, rounded spots on each side of the median line in the basal half of each segment. Apical pleural angles pale. Ventrally fuscous, with a paler median line running the length of segments 2–8. Basal margin of each segment darker, and in the basal half, on each side of the pale line, an oblique divergent streak and a rounded spot of darker fuscous (Pl. X. fig. B). These markings become progressively smaller from base to apex of abdomen, and vary in their distinctness in different individuals. Tergite 9 fuscous, with a large, rounded, pale, median area; tergite 10 dark fuscous. Sternite 9 dark fuscous, with a quadrate pale area at the centre of its apical margin. Basal segment of forceps yellowish, with a dark fuscous spot at its base and somewhat olivaceous at its apex; remainder of forceps pale olivaceous, shading to smoky white at the tip (Pl. X. fig. C). Setæ dark fuscous, becoming paler apically. Anterior legs dark olivaceous, femora paler above; median and posterior legs whitish, with faint olivaceous markings.

Wings hyaline, venation dark olivaceous, except at base of anterior wing, where it is whitish. Three longitudinal veins in hind wing, costal projection acute (Pl. X fig. A).

Length of anterior wing 10 mm.

Adult ♀ (in formalin).—Notum castaneous, abdomen dark fuscous above, distal pleural angles pale. Dorsal markings as in ♂. Median area of tergite 9 pale. Ventrally the abdomen is very pale fuscous, with dark markings as in ♂, basal pleural angles with a rounded fuscous spot. Setæ dark fuscous. Legs coloured as in ♂. Wings hyaline, with a distinct smoky brown tinge, venation fuscous.

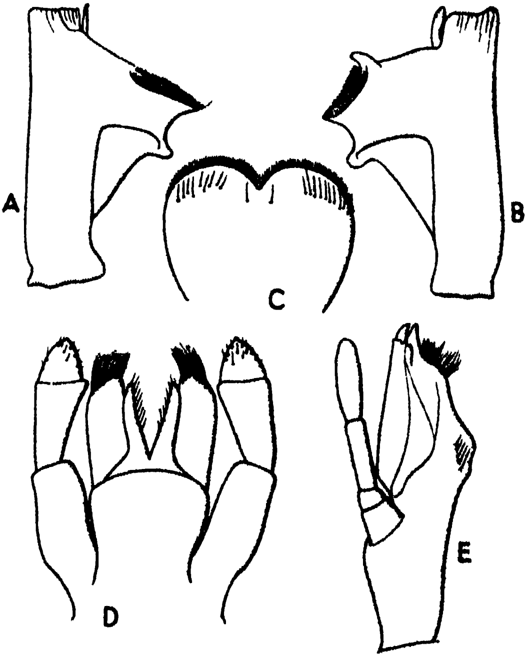
Subimago ♂ (in formalin).—Turbinate eyes light yellowish red, lower eyes fuscous. Notum yellowish brown, with fuscous and piceous markings. Abdomen smoky yellow-brown, apical margins of tergites with a transverse fuscous streak on each side. These streaks become more triangular on the apical segments. The dark spots of the adult are represented by pale areas. Ventrally the abdomen is pale smoky yellow, basal pleural angles fuscous. Dark spots of the adult again represented by pale areas. Setæ and apices of forceps smoky grey. Anterior femur pale smoky yellow, marked towards the apex with fuscous, as follows:—Anterior surface, a lunate spot; posterior surface, a streak about one-third of the length of the femur. Tibia and tarsus smoky grey. Median and posterior femora as in anterior, tibiæ and tarsi paler. Wings smoky grey.

♀ subimago somewhat paler than ♂.

MOROCCO: Atlas Mountains, R. Amengous (an upper branch of the Oumer Rebia), v. 1937 (*A. H. Batten-Pooll*).

Type ♂, paratypes ♂ and ♀, and subimagines in the British Museum (Nat. Hist.) collection, presented by Mr. Batten-Pooll.

This species appears to be related to *Baëtis bocagii* Et., *B. melanonyx* Pict., and *B. alpinus* Pict. From *B. bocagii* (which I know only from description) it may be separated by its darker setæ and the longer terminal segment of the forceps. From *B. melanonyx* it differs in the absence of a small tooth at the apex of the second segment of the forceps, different coloration of the basal segment, and darker setæ and neuration. From *B. alpinus* it differs in the forceps being not angulate in lateral aspect and in its darker setæ.



Baëtis maurus, sp. n., nymph.
A, B, right and left mandibles; C, labrum; D, labium; E, maxilla.

Included in an autopsy of a trout taken from the Oumer Rebia itself were numerous *Baëtis* nymph just at the stage of disclosing the subimago and also some younger nymphs. From the evidence of the [illegible] nymphs, which showed the subimaginal characters through the nymphal skins, I think that there is little doubt that the nymphs are those of *B. maurus.* I am figuring one of the nymphs (Pl. X. fig. E) and the mouth-parts of one of the transforming nymphs. As will be seen, the nymph has quite a definite colour-pattern (dark olive-green on cream), but the most noticeable character is the very abbreviated median caudal seta, a feature which also occurs in *B. alpinus* and *B. melanonyx.* The mouth-parts differ slightly from those of *B. rhodani* ; in particular the terminal segment of the labial palpus is differently formed.

EXPLANATION OF PLATE X.

Baëtis maurus, sp. n. A–C, adult ♂ ; D–E, nymph.

A, hind wing ; B, pattern of sternite ; C, forceps from beneath ; D, legs of nymph ; E, nymph from above.

XXXVI.—*A new Gecko from Sokotra.* By H. W. Parker, Department of Zoology, British Museum (Natural History).

In endeavouring to determine some geckoes of the genus *Pristurus* from Somaliland the author was drawn into a reconsideration of the species *P. rupestris* Blanford, said to extend from Karachi through Iran, the islands of the Persian Gulf, south eastern Arabia, and Somaliland to Abd-el-Kuri and Sokotra. It was obvious that whereas true *rupestris* was a very small species, those examples from Abd-el-Kuri and Sokotra usually referred to were very much larger and had a most distinctive colour-pattern, more strongly compressed tails, and longer, more acuminate snouts. The latter character has already been stressed by Anderson (1895, p. 24), who suggested that they ought to be given subspecific status. Boulenger (1903, p. 78) was not convinced that the differences warranted such treatment, contending that " the name of the species, coupled with an indication of the locality, is amply sufficient for all purposes."

But with the much larger series of specimens now available for comparison it seems certain that the Sokotran geckoes have really very little to do with *rupestris*, but represent a distinct species more closely akin to *P. flavi-*

punctatus Rüppell, so that a new name becomes necessary for their designation. They may be known as

Pristurus sokotranus, sp. n.

Pristurus rupestris (part) Boulenger, 1885, Cat. Lizards Brit. Mus. i. p. 53; Anderson, 1895, Herpet. Arabia, p. 23; Boulenger, 1903, Nat. Hist. Sokotra and Abd-el-Kuri, p. 76; Mertens, 1934, Zoologica, xxxii. 84, p. 50.

Holotype a male, number 99.12.5.15 in the British Museum, from Dahamis, Sokotra, collected by Grant and Forbes.

Snout depressed, acuminate, much longer than the distance between the eye and the ear-opening; maximum width of the head less than the distance between the tip of the snout and the posterior border of the eye; forehead distinctly concave; ear-opening small, subcircular. Upper surfaces covered with fine, subequal, juxtaposed granules, except the upper surface of the snout, which has larger, flat, subhexagonal plates; throat granular; chest and abdomen with subimbricate scales a little smaller than those on the snout. Rostral large, with a median cleft; six or seven supralabials; nostril pierced between the rostral and two nasals, the upper of which is separated from its fellow by a single small granule. Mental very large, followed by four lower labials. Limbs slender, the tip of the longest toe reaching the ear when the hind limb is adpressed; 22 or 23 lamellæ beneath the fourth toe. Tail strongly compressed, with a median crest dorsally composed of lanceolate scales 1·5 mm. long; two or more rows of scales are involved in the crest posteriorly; ventral surface of the tail with enlarged, imbricate, pointed scales.

Upper surfaces pale brown; a light median stripe from the occiput to the base of the tail and a light lateral stripe from beneath the eye above the fore limb to the groin; the lateral stripe is edged above with a series of dark brown spots, which in the neck-region tend to be connected to their fellows of the opposite side by a backwardly curved bar. Flanks below the lateral line with darker vermiculations and light spots. Lower surfaces white, the chin and throat dotted with darker.

Length from snout to vent	36 mm.
Tail	57 mm.

Paratypes :-

B.M. 81.7.22.14–19, 3 ♂♂, 3 ♀♀. Sokotra ; coll. Balfour.
99.12.5.11-12, ♂♀. Hadibu Plain, Sokotra ; coll. Grant & Forbes.
99.12.5.16-18, ♂, 2 ♀♀, 2 juvs. Dahamis, Sokotra ; coll. Grant & Forbes.
99.12.5.19–24, 3 ♂♂, 2 ♀♀, juv. Jena agahan, Sokotra ; coll. Grant & Forbes.
99.12.5.25–26, ♂♀. Hambil, Sokotra ; coll. Grant & Forbes.
99.12.5.27-32, 4 ♂♂, 3 ♀♀. Adho Dimellus, Sokotra ; coll. Grant & Forbes.

The characters of this series have already been dealt with by Boulenger (*loc. cit.*). Suffice it to add that the tail of the female is less compressed than that of the male, with a much less marked crest. The striped colour is characteristic of the majority of the specimens and is found in no other species of the genus ; the dorsal stripe is the least constant, but the laterals are absent in one specimen only. Usually the space between the dorsal and laterals is dark brown with a single row of circular white spots ; enlargement of these spots reduces the dark colour to a series of curved transverse bars, which may be incomplete, as in the type.

The species is most closely allied to *P. flavipunctatus* Rüppell, but is distinguished by the entire absence of any dorsal crest on the body, by its longer, more depressed snout, and colour. From *P. rupestris* it is distinguished by its more compressed, more strongly crested tail, longer, concave snout, more numerous subdigital lamellæ (20–26 *vice* 18–24), larger size (maximum for *rupestris* 30 mm. from snout to vent, *vice* 39 mm. for *sokotranus*), and colour.

Boulenger (1903, p. 94) has recorded "*Pristurus rupestris*" also from Abd-el-Kuri. The specimens from this island, as he points out, do not show the stripes so characteristic of the Sokotran series, though they resemble it in their morphological characters. At present it seems advisable to use the name *sokotranus* for the *Pristurus* of Abd-el-Kuri also, though further collecting may reveal that the colour differences are sufficiently constant and well-marked to warrant the use of a distinctive name.

XXXVII.—*Neue Uebersicht ueber die Arten der Gattung* Glyphodera *End.* (*Dipt. Acalypt.*, Tylidæ). Von Dr. Willi Hennig, Berlin-Dahlem.

Durch Herrn Dr. John Smart erhielt ich aus der Sammlung des British Museum eine grössere Anzahl von Tyliden zur Bestimmung übersandt. Während im allgemeinen eine Beschreibung der darunter befindlichen vermutlich neuen Arten und Subspecies nicht lohnt, da sie alle zu Gattungen gehoeren, in denen sich Einzelbeschreibungen neuer Arten nicht rechtfertigen lassen, gibt mir eine unter einer Reihe von Dr. F. W. Edwards in Afrika gesammelter Arten befindliche neue Art der Gattung *Glyphodera* Enderlein Gelegenheit, die Arten dieser Gattung einer erneuten Revision zu unterziehen. Eine solche lässt sich umso mehr rechtfertigen, als mir jetzt alle Arten durch ihre Typen bekannt sind, mit Ausnahme der häufigen und wohl kaum falsch gedeuteten *Glyphodera cephalotes* Walker und der *Glyphodera albicalcanea* Speiser, die wohl Synonym dazu ist. Die folgende Uebersicht baut auf meiner ‘ Revision der Tyliden ’ auf, in der die Gattung *Glyphodera* in Konowia 14 (1935) Seite 72–75 behandelt ist.

1. *Verbesserte Uebersicht ueber die Arten der Gattung.*

♂♂.

1 (2).	♂♂ unbekannt (Bestimmung nach der ♀-Tabelle versuchen !)	[*badia* Czerny. *vitripennis* Enderl.,
2 (1).	♀♀ bekannt.	
3 (8).	Zinken der Kopulationsgabel parallel (siehe Abbildung 2 in Konowia 14, p. 73).	
4 (5).	Am Vordertarsus ist wenigstens das 1. Glied (Metatarsus) weiss. Thorax rostrot	*ochripes* Enderlein (Syn. : *gambogipes* Czerny).
5 (4).	Vordertarsus ganz schwarz, ohne weisses 1. Glied.	
6 (7).	Thorax rostrot	*cephalotes* Walker (Syn. : *albicalcanea* Speiser).
7 (6).	Thorax blauschwarz	*ugandensis* Hennig.
8 (3).	Zinken der Kopulationsgabel kreisförmig gebogen (siehe Abbildung 3 in Konowia 14, p. 74).	
9 (10).	Vordertarsus ganz schwarz, höchstens auf der Unterseite des 1. Gliedes	

(Metatarsus) etwas gelbliche Behaarung .... *mantis* Enderlein.
10 (9). 1. Glied des Vordertarsus (Metatarsus) rein weiss.
11 (14). Thorax rostrot oder rotgelb.
12 (13). Am Hintertarsus sind Glied 1–3 weiss. Thorax rostrot. Flügelquerbinden deutlich .... *annulimanus* Enderlein.
13 (12). Am Hintertarsus ist nur Glied 1 weiss. Thorax rotgelb. Flügelquerbinden sehr undeutlich .. *luteola*, nova spec.
14 (11). Thorax schwarz mit blauem Glanze. Am Vordertarsus ist nur Glied 1 weiss. Flügelquerbinden deutlich .... *fissicollis* Enderl.

♀♀.

1 (2). ♀♀ unbekannt (Bestimmung nach ♂-Tabelle versuchen !) .... [*luteola*, sp. n. *annulimanus* Enderl.,
2 (1). ♀♀ bekannt.
3 (8). 1. Glied (Metatarsus) des Vordertarsus weiss.
4 (5). Flügel mit subbasaler brauner Querbinde, im Spitzendrittel ganz braun (bei *tp* beginnend) .... *badia* Czerny.
5 (4). Flügel im Spitzendrittel nicht einfarbig braun. Medianquerbinde und Apikalfleck deutlich getrennt.
6 (7). Mittel- und Hinterschenkel lebhaft hell ockergelb, ohne deutliche braune Zeichnung.............. *ochripes* Enderl. (Syn. : *gambogipes* Czerny).
7 (6). Mittel- und Hinterschenkel dunkel braun, nur Basal- und Spitzenviertel oder noch weniger bräunlich gelb .... *fissicollis* Enderl.
8 (3). Vordertarsus ohne weisses Glied.
9 (10). Grundfarbe der Beine schwarz. Mittel- und Hinterschenkel mit gelbem Subapikalring .... *mantis* Enderl.
10 (9). Grundfarbe der Beine ausgesprochen ockergelb (bis rotgelb).
11 (12). Flügel hyalin, ohne braune Querbinden .... *vitripennis* Enderl.
12 (11). Flügel mit sehr deutlichen braunen Querbinden.
13 (14). Thorax rostrot .... *cephalotes* Walker (Syn. : *albicalcanea* Speiser).
14 (13). Thorax blauschwarz .... *ugandensis* Hennig.

2. *Verzeichnis der bekannten Arten* (Die in Klammer beigefügten Seitenzahlen beziehen sich auf meine 'Revision der Tyliden,' Konowia 14).

1. *Glyphodera cephalotes* Walker (p. 72).—Bisher nur aus Westafrika bekannt. Es ist wahrscheinlich dass die

folgende Art die ostafrikanische Vikariante (Rasse) darstellt. Dass *G. albicalcanea* Speiser als Synonym anzusehen ist, halt ich jetzt für nahezu sicher.

2. *Glyphodera ugandensis* Hennig (p. 72).—Die Art wurde von mir als Subspecies von *ochripes* Enderl. beschrieben, von der sie sich durch schwarzen Metatarsus der Vorderbeine unterscheidet. Ich halte es jetzt für wahrscheinlich, dass sie als ostafrikanische, durch verdunkelten Thorax ausgezeichnete Vikariante von *cephalotes* angesehen werden muss. Von Dr. Edwards gesammelt in Uganda (Ruwenzori Range).

3. *Glyphodera ochripes* Enderlein (p. 75).—In meiner Artentabelle, Konowia 14 p. 71 unterschied ich *gambogipes* nach Czernys Beschreibung auf Grund dreier weisser Glieder der Mitteltarsen von den übrigen Arten. Der Typus von *G. gambogipes* im Deutschen Entomologischen Institut, Berlin-Dahlem beweist aber, dass Czernys Angabe irrig ist. Die Mitteltarsen sind wie bei den ubrigen Arten vollkommen dunkel, nur die Glieder 1–3 der Hintertarsen sind weiss. Ich verglich Czernys Typus mit dem Typus von *ochripes* im Zoolog. Museum der Universität Berlin und muss demnach die beiden Arten fur identisch halten. Beschrieben aus Westafrika. In der Sammlung des British Museum liegt mir 1 ♀ aus Ostafrika (Uganda, Kalinzu Forest) vor, das sich am Vordertarsus nicht von den westafrikanischen unterscheidet. Daher kann ich *ugandensis* nicht mehr als ostafrikanischen Vertreter von *ochripes* ansehen, vergleiche unter No. 2.

4. *Glyphodera fissicollis* Enderlein (p. 73).—In meiner 'Revision der Tyliden' (*l. c.*) gab ich irrtümlich an, dass die Zinken der Kopulationsgabel parallel seien wie bei *ochripes*. Ein nochmaliger Vergleich des Typus zeigt aber, dass sie tatsächlich rundlich gebogen sind, wie Enderlein angibt, also denen von *G. mantis* gleichen. Dagegen ist Enderleins Angabe, dass der Metatarsus der Vorderbeine beim ♀ im Gegensatz zum ♂ dunkel sei, unzutreffend. In Wirklichkeit dürfte die Beinfärbung des ♀ der des ♂ entsprechen. Enderlein wurde dadurch getäuscht, dass das von ihm erwähnte (einzige) ♀ (von mir im Zoolog. Museum Berlin verglichen) noch ganz

unausgefärbt, sehr geschrumpft und teilweise gequetscht ist. Die wirkliche Beinfärbung ist bei ihm überhaupt nicht zu erkennen. Immerhin sieht man deutlich, dass der Vordertarsus wenigstens zum grössten Teile (mit Ausnahme von Basis und Spitze) weiss ist. Von Dr. Edwards gesammelt in Uganda (Budongo Forest).

5. *Glyphodera mantis* Enderlein (p. 73).—Von Dr. Edwards gesammelt in Uganda (Ruwenzori Range und Budongo Forest).

6. *Glyphodera annulimanus* Enderlein (p. 74), mit der ostafrikanischen Subspecies *orientalis* Hennig (p. 74).

7. *Glyphodera vitripennis* Enderlein (p. 75).—Bisher nur aus Kamerun bekannt. 2 von Dr. Edwards in Uganda (Ruwenzori Range, Mobuku Valley, 4500 ft., und Kilembe) gesammelte ♀ gleichen dem Typus vollkommen. Sie besitzen aber vor dem Stemmatikum einen mattschwarzen Sammetfleck, der dem Typus fehlt. Doch ist der Typus ein unausgefärbtes Exemplar, das schwer zu vergleichen ist. Vielleicht handelt es sich hierbei aber um einen charakteristischen Unterschied der ost- und der westafrikanischen Exemplare?

8. *Glyphodera badia* Czerny (p. 75).—Holotypus im Deutschen Entomologischen Institut verglichen.

9. *Glyphodera luteola*, nova spec.

Offenbar mit keiner der bekannten Arten besonders nahe verwandt, Unterscheidung nach der Tabelle.

Der ganze Körper ist gelbrot, Stirnstrieme mit einem fast kreisrunden, sammetschwarzen Flecken, der oben die Ozellen eben umfasst. Ein grosser viereckiger Fleck des Scheitels, der nach hinten bis zum Foramen reicht, ist blauschwarz. Von Kopfborsten sind nur 2 Paare vorhanden, die wohl den vti und den orss (oberstes Paar der normal vorhandenen 3 ors) entsprechen. Vor den orss noch ein sehr feines Härchen, das wohl der obersten der sonst vorhandenen 2 orsa entspricht. 3. Fühlerglied schwarzbraun, Fühlerborste kurz behaart.

Thorax rotgelb, ohne Besonderheiten, 1*sc*, 1*dc*, 1*sa*, 1*n* beim Typus als einzige Borsten vorhanden. Vor

den Mittelhüften (cx_2) stehen auf der Ventralseite jederseits etwa 2 nach abwärts gerichtete auffällige Borsten. Die beiden Abdominalsegmente 1 und 2 sind deutlich verlängert. Die einzelnen Abdominalsegmente sind stellenweise etwas unregelmässig verdunkelt. Die Zinken der Kopulationsgabel sind wie bei *ochripes* (Abbildung 2 in Konowia 14 p. 73) kreisförmig gebogen. Beine etwas verdunkelt. Vorder- und Hintertarsen und -tibien braun. Am Vordertarsus sind Glied 1 und 2 schneeweiss. Am Hintertarsus ist nur Glied 1 mit Ausnahme der Spitze weiss. Flügel ohne jede Zeichnung. cu_2+an etwas länger als cu_2. r_{2+3} mündet gegenüber *tp*.

Körperlänge etwa 6 mm., Flügellänge etwa 4 mm.

Holotypus : 1 ♂, Uganda, Budongo Forest, 7–8. ii. 1935, F. W. Edwards leg., B.M. 1935–203, im British Museum.

XXXVIII. *New African* Hesperiidæ (*Lepidoptera*). By Brigadier W. H. Evans, C.S.I., C.I.E., D.S.O., F.R.E.S.

Among some Hesperiidæ sent to the British Museum for identification by Mr. T. H. E. Jackson of Kenya there were found to be two new species and a new subspecies, which are described below. The types are in the British Museum.

Metisella orientalis elgona, subsp. n.

Above exactly like *Metisella orientalis theta* Evans (1937, Cat. Afric. Hesp. p. 71) except that, on the hind wing above, the usual submarginal spots are absent and there remain only a large discal spot in spaces 4–5 and a smaller spot at the base of space 2. On the fore wing, below, the yellow basal costal streak is absent. The hind wing below is dull ferruginous brown; the basal cell-spot and the spot in spaces 4–5 are distinct, that in space 2 is very faint, and there is no trace of any submarginal spots.

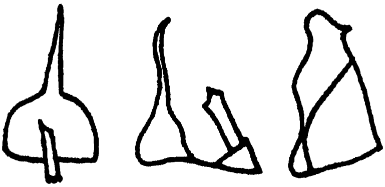
♂.—Mount Elgon, 12,000 feet ; January 1925.

Length of fore wing 13½ mm.

Gastrochæta budonga, sp. n.

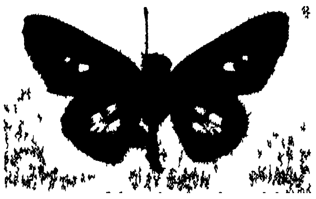
Above black with a faint purple sheen. Fore wing, above, a small non-hyaline irregular white spot over and against the middle of vein 1; a large quadrate hyaline discal spot near the base of space 2, and a similar smaller spot beyond in space 3. Hind wing, above, a large irregular white area occupying the centre half of the wing from vein 1 *b* to the costal vein and vein 6, divided by a black bar at the end of the cell, and the veins (2, 3, 4) crossing the white area are narrowly black; the hairy clothing along the dorsal side of vein 1 *b* is whitish. Fore wing, below, dull black; base of costa with pale yellow scaling; the spots in spaces 2 and 3 as above; the spot in space 1 *b* only indicated by a few scattered scales. Hind wing, below, yellowish white, outwardly white, with a very narrow black border, broadening at tornus to a width of 2 mm. Cilia plain smoky-black. Thorax and abdomen black above; below, yellowish white, and the thorax at the sides, between the legs and the wings, clothed with orange hairs. Palpi missing, but probably ochreous

Fig. 1



Gastrochæta budonga, sp. n. Outlines of ♂ genitalia.

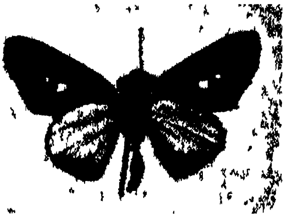
Fig. 2



Gastrochæta budonga, sp. n. Upperside.

below Antennæ missing. Secondary sexual characters as in *Gastrochæta cybeutes* Holland, a dark brown hair-tuft on the hind wing above, from the cell, entering a pouch along the median vein

Fig 3



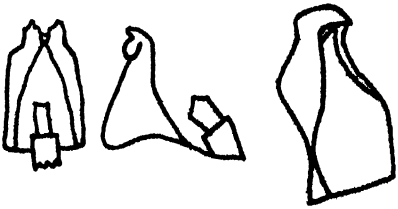
Gastrochæta budonga, sp n Underside.

A very distinct species, with no near ally.
♂.—Budongo, Uganda, November 1935
Fore wing 16 mm.

Baoris kaka, sp. n.

Above very dark brown, with the following small hyaline white spots on the fore wing: narrow and vertical in space 2, dots in spaces 3, 4, 6, 7, 8 Below uniform dark brown; fore wing spots as above; hind wing with white dots in spaces 3 and 6.

Fig 4.



Baoris kaka, sp. n. Outlines of ♂ genitalia.

Only differs from *Baoris fatuellus* (Hopffer) in being darker, with smaller spots and without any spot in space 1 *b* on the fore wing above or below; also the genitalia differ, as will be seen from a comparison of the figures here given with those of *B. fatuellus* in the 'Catalogue of African Hesperiidæ' (B.M. 1937).

♂.—Kakamega, Kenya.

Fore wing 18 mm.

XXXIX.—*The* Hippoboscidæ (*Diptera*) *recorded from Ceylon*. By GORDON B. THOMPSON.

[Plate XI.]

THIS short paper contains a list of the species of Hippoboscidæ recorded from Ceylon. Two additional species are listed, as it is almost certain that they will be found on the island. Records of two species previously recorded are included, one of them with notes and illustrations.

The Hippoboscidæ comprise an extremely interesting family of Diptera which are parasitic on birds and mammals. Unfortunately, however, we know very little of the hosts which they parasitize, owing to the fact that in the past they have frequently been recorded, but seldom with any indication as to their hosts. It seems to me that in the present state of our knowledge of the ectoparasitic Arthropoda it is almost impossible to give too much data when publishing records.

I wish to record my thanks to Dr. Jos. Bequaert for his kind help and guidance, to Capt. W. W. A. Phillips for the specimens, and to Dr. J. W. Shackle for the excellent photographs.

Hippoboscidæ.

Subfamily HIPPOBOSCINÆ.

1. *Hippobosca maculata* Leach.

Hippobosca maculata Leach, 1818, Mem. Wern. nat. Hist. Soc. ii. pp. 553–554, pl. xxvi. figs. 11–13.

Hippobosca maculata Leach, Bequaert, 1930, 'Psyche,' Camb., Mass., xxxvii. pp. 317–320.

Bigot (1885, Ann. Soc. ent. Fr. (6) v. pp. 236–237) described a species under the name *H. calopsis* from Ceylon which Bequaert (1930, *loc. cit.*) considers to be a synonym of *H. maculata* Leach. Brunetti (1910, Spolia zeylan. vi. pl. xxiv. p. 172) recorded the species as *H. variegata* Leach from Ceylon, Passara. It appears to be a normal parasite of domestic cattle and equines.

2. *Hippobosca longipennis* Fabricius.

Hippobosca longipennis Fabricius, 1805, 'Systema Antliatorum,' p. 338.
Hippobosca longipennis Fabricius, Bequaert, 1930, 'Psyche,' Camb., Mass., xxxvii. p. 314.

This species, of which *H. capensis* v. Olfers (1816) and *H. canina* Rondani (1878) are synonyms, has been recorded from various parts of India, but not from Ceylon. It may be expected to occur there. Nowadays it appears to be most commonly found on dogs.

Subfamily *Ornithomyiinæ*.

3. *Ornithoctona plicata* (v. Olfers).

Ornithomyia plicata v. Olfers, 1816, 'De vegetativis et animatis corporibus in corporibus animatis reperiundis commentarius,' Berlin, part 1, p. 102.

v. Röder (1893, Ent. Nachr. xix. p. 236) and Bau (1929, Zool. Anz. lxxxv. p. 10) recorded *Ornithomyia nigricans* Leach, which is a synonym of *O. plicata* (v. Olfers), from South Ceylon. Both records were based on the same specimen. There is no indication of the host.

4. *Lynchia longipalpis* (Macquart).

Olfersia longipalpis Macquart, 1835, Histoire Naturelle des Insectes, Diptères, ii. p. 640.

Van der Wulp (1897, Termeszetr. Füz. xx. p. 144) recorded *L. longipalpis* (Macquart) from Ceylon under the name *Olfersia longirostris*, which he described from Kala-Wewa and Mudatugama without indication of host. Speiser (1904, Zeit. syst. Hym. Dipt. iv. p. 88) examined van der Wulp's types, and synonymized the species with *longipalpis* Macquart, which was described from Java.

5. *Pseudolynchia maura* (Bigot).

Olfersia maura Bigot, 1886, Ann. Soc. ent. Fr. (6) v. p. 237.
Pseudolynchia maura (Bigot), Bequaert, 1925, 'Psyche,' Camb., Mass., xxxii. p. 273.

Up to the present this species has not been recorded from Ceylon, but as it has now become an almost cosmopolitan parasite of domestic pigeons it may be expected to occur there. It has been recorded from various parts of India.

6. *Cratærina acutipennis* Austen.

Cratærina acutipennis Austen, 1926, 'Parasitology,' xviii. pp. 355–356, fig. 1 *a*.

This species was originally described from Canary Is., Transvaal, and Natal, off *Micropus* spp. Ferris (1930, Philipp. J. Sci. xliii. p. 547) recorded a single female from Ceylon off *Micropus affinis nipalensis* Hodgson ("*Cypselus affinis*").

7. *Myiophthiria* sp.

Austen (1926, 'Parasitology', xviii. p. 360) recorded a specimen of a probable new species of this genus from Ceylon, Pundaluoya, taken in the nest of *Collocalia u. unicolor* Jerdon (Nilghiri swift).

Subfamily *MELOPHAGINÆ*.

8. *Lipoptena efovea* Speiser. (Pl. XI. figs. 1 & 2; and text-figure.)

Lipoptena efovea Speiser, 1905, Zeit. syst. Hym. Dipt. v. p. 352.

This species was originally described from Ceylon without indication of host. As a number of specimens in excellent condition and taken from a known host are at hand, the following notes, together with the illustrations, will, it is to be hoped, help towards an easy recognition of the species in future.

Specimens examined.—10 ♀♀, 6 ♂♂ (all wingless) off *Axis axis ceylonensis* Fitzinger (Ceylon spotted deer). See below for further details of this record.

Female.—Length (on slide) 3·75 mm. (Pl. XI. fig. 2.)

Male.—Length (on slide) 2·7 mm. (Pl. XI. fig. 1.)

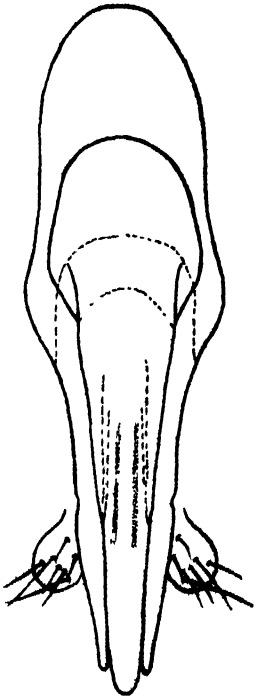
General colour, pale to dark brown.

Female.—*Head* roughly one-third broader than long. Devoid of setæ except for two very stout (1, 1), four medium-sized (2, 2), and two (1, 1) very small setæ. Ventrally beset with numerous small setæ along the orbits etc. Frontal vitta somewhat elongate, rough in appearance; ocellar area small, a little more than one-third the length of the head.

Thorax a little broader than long, bearing few setæ; pre-alars with two rows of stout setæ—three long stout, and four short stout ones anterior to them. On post-alars a group of four stout setæ—three small and one long.

Ventrally the meso- and metasternum are thickly beset with short, stout setæ arranged roughly in rows from side to side. Scutellum bears six setæ—four short, two long—on its posterior margin. Legs stout—not bearing many setæ dorsally, more ventrally. Claws slender, slightly asymmetrical.

Abdomen (for arrangement of setæ see Pl. XI.).—The greater portion of the abdomen is membranous, with very few setæ except on the posterior margin of the four plates. Ventrally the greater portion of the abdomen is covered with small slender setæ. Basal sternite slightly emarginate, thickly beset with small stout setæ—those setæ on the outer margin somewhat longer than the remainder. The ventral margin of the basal sternite is bordered with very small slender setæ.



Genitalia of *Lipoptena efovea* Speiser, ♂. × 125.

Male.—Closely resembles the female,

Genitalia (text-figure) consisting of a pair of stout, chitinized pointed processes attached to a basal plate; projecting between these is another more bluntly pointed structure. The figure is drawn from genitalia *in situ*.

Larvæ.—Two females of the series examined have larvæ within their abdomens. The posterior portion of the larvæ is heavily chitinized—black. The condition of the specimens does not enable me to discern the connections between the larvæ and the tracheal system of the adults.

L. efovea Speiser seems to come very close to *L. cervi* (Linn.)—the common parasite of European deer. The genitalia appear to be almost identical in these two species.

New Records.

Hippobosca maculata Leach.

"On Black Bullock," Ceylon, Dambulla, 16. iii. 1934.

Lipoptena efovea Speiser.

Axis axis ceylonensis Fitzinger (Ceylon spotted deer), Ceylon, E.P., Nikkawewa, near Kantalai, 200 ft., 20. i. 1936 (*W. W. A. Phillips*). (See above.)

Panthera pardus fusca (Meyer) (Indian leopard), Ceylon, Amurdhapura, 15. iii. 1934. A single female.

EXPLANATION OF PLATE XI.

Fig. 1. *Lipoptena efovea* Speiser, ♂. × 15.
Fig. 2. Ditto, ♀. × 15.

XL.—*Deux Cercopides nouveaux de l'Equateur.*

Par le Dr. V. Lallemand.

Sphenorhina intricata, sp. n.

Noire ; de chaque côté du pronotum et du prosternum, au bord antéro-lateral, une grande tache rouge-foncé mal limitée. Sur les élytres, une bande transversale et une tache rouge sombre (presque rouge noirâtre) mal limitées et peu tranchées, la bande se trouve près de la base et la tache au bord externe au-devant du tiers apical.

Elytres densément ponctués, granuleux, à nervures visibles, mais peu saillantes ; écusson transversalement

strié, déprimé en cuvette large et peu profonde ; sur le pronotum une carène médiane n'atteignant pas le bord postérieur ; sur le front une carène médiane nette, vu de coté, il montre un angle droit ; rostre atteignant presque la base des hanches postérieures ; deux épines sur les tibias postérieurs, une très petite près de la base et une forte près de l'extrémité.

Longueur : 11 mm.

Equateur : Huigra, v. 1923, 4000 ft. (*F. X. Williams*).

Type : ma collection ; paratype : collection du British Museum.

Sphenorhina fallaciosa, sp. n.

♂, noire ; sont rouge carmin : les bords antérieurs du vertex, les bords antérieur (étroitement) et latéro-antérieurs (un peu plus largement) du pronotum, la partie antérieure du prosternum, une tache à la base et à l'extrémité des hanches, les cuisses antérieures et médianes, les tibias et le métasternum ; abdomen rouge brun, mais plus rouge sur la ligne médiane, le bord postérieur de chacun des segments est rouge carmin ; extrémité de l'écusson jaune ; sur les élytres, deux bandes transversales jaunes, assez étroites, la première partant de l'extrémité de l'écusson, la seconde de la pointe du clavus, qu'elle colore ; la carène du front est noire rougeâtre, plus rouge vers l'angle.

♀, plus rouge ; le quart antérieur du pronotum est rouge, mais sans limites précises avec la partie postérieure noire, les deux colorations se mélangent ; les pattes sont rouges, les cuisses postérieures, les tarses et la pointe des épines, le second article du rostre brun rougeâtre.

Deux épines sur les tibias postérieurs, la première près de la base est très petite ; médian et cubitus soudés sur le tiers antérieur ; sur l'écusson, une grande fossette médiane et deux petites latéro-antérieures sur le pronotum, trace de carène médiane sur sa partie antérieure ; écartement des ocelles égal à la moitiè de la distance séparant les yeux des ocelles, entre eux une fine carène ; front, vu de côté dessinant un angle saillant, à peu près droit.

Longueur : 10 mm.

Equateur : Bucay (*F. X. Williams*).

Types : ma collection ; paratype : collection du British Museum.

THE

ANNALS AND MAGAZINE

OF

NATURAL HISTORY.

[ELEVENTH SERIES.]

No. 4. APRIL 1938.

XLI.—*Jurassic Mollusca from Southern Arabia collected in 1936 by Mr. H. St. J. B. Philby.*

By L. R. Cox, M.A., Sc.D., Department of Geology, British Museum (Natural History).

[Plate XII.]

INTRODUCTION.

Marine Jurassic rocks are already known to occur in several parts of Arabia. They appear to have been discovered first by F. R. Mallet on a journey in the Aden hinterland; F. Stoliczka, whose brief report is quoted by Mallet (1871, p. 282), did not, however, consider the fossils collected to be specifically determinate. The earliest detailed account of fossils from this area is in a paper by R. B. Newton and G. C. Crick (1908), who describe a small series of Kimmeridgian mollusca collected by Major H. S. Hazelgrove from localities situated about 50 and 100 miles north of Aden. Not long afterwards there followed a short paper by G. H. Tipper (1910) describing fossils from the same horizon and district collected in 1906 by R. E. Lloyd.

The discovery of Jurassic rocks further east, in the Makalla Sultanate, was due to O. H. Little, whose collection of fossils, consisting of mollusca and brachiopods, was described by G. Stefanini (1925); these fossils appear to be of approximately Upper Argovian age. Stefanini (1925, p. 194) also refers to a small undescribed collection of Jurassic fossils formed by G. Wyman Bury in an intermediate district, situated in the hinterland of Shugra. He quotes an opinion expressed by Professor E. Dacqué (*in litt.*) that these fossils, in view of the presence of the molluscan genus *Posidonia*, are of Upper Dogger (Callovian) age; but Stefanini points out that *Posidonia* occurs in the matrix of Argovian ammonites in Makalla, and so is of little use as an indication of horizon *.

Fossiliferous Jurassic rocks had meanwhile been discovered by Mr. H. St. J. B. Philby along the Tuwaik plateau of Central Arabia. His first collection, made in 1918, was described by R. B. Newton (1921), who considered the fossils to be of "Sequanian–Kimmeridgian" age. A further collection from this same area, made by Mr. Philby in 1931–2, was reported upon by me (1933); my conclusion was that these fossils, as well as those described by Newton, should be referred to the Callovian rather than to the "Sequanian–Kimmeridgian."

Jurassic rocks have also been discovered in the Yemen, by P. Lamare. The collections of fossils made by this explorer come from the neighbourhood of Amran, north of Sanaa, and are described in a paper by Mlle. E. Basse (1930, pp. 135–145). They are assigned by her to a "Sequanian–Kimmeridgian" horizon.

The mollusca which form the subject of the present report were all collected by Mr. Philby from the 'Alam Aswad ridge (15° 55′, 45° 40′), some 130 miles east of Lamare's localities. They occur, mainly in the form of casts, in a moderately hard white limestone, the exposed thickness of which amounts to about 200 feet. This deposit also yielded a few corals and numerous branching Hydrozoa belonging to the genus ***Milleporidium***, which are at present being studied by my colleague Dr. H. D. Thomas. For a Jurassic deposit the abundance and large size of these Hydrozoa is remarkable. One fossil particularly worthy of note is a nodular coral-growth containing the very clearly preserved external mould of the species *Pteroperna modiolaris*.

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* In British Somaliland a species of *Posidonia* occurs in abundance in shales of Kimmeridgian age (L. R. Cox, 1935, p. 166).

The following is a list of the mollusca described in the present paper :—

Navicula (*Eonavicula*) cf. *quadrisulcata* (J. de C. Sowerby).
Modiolus jurensis (Merian MS., Roemer).
Brachidontes (*Arcomytilus*) *subpectinatus* (d'Orbigny).
Pteroperna modiolaris (Münster).
Entolium cf. *demissum* (Phillips).
Lima (*Plagiostoma*) aff. *harronis* Dacqué.
Lucina sp. indet.
Lucina sp. n.
Corbis cf. *subdecussata* Buvignier.
Mactromya sp. indet.
Cardium bannesianum Thurmann MS., Contejean.
Ceratomya excentrica (Voltz MS., Roemer).
Globularia cf. *hemisphærica* (Roemer).
Nerinea sp. indet.

Although the collection has yielded only five definitely determinable species, there can be no doubt as to the Upper Jurassic age of this assemblage. One or two of these species have a moderately extended geological range within the Upper Jurassic, but I consider that the balance of the evidence suggests that the horizon represented is approximately Lower Kimmeridgian (Sequanian). The beds are, therefore, probably a continuation of those discovered by Lamare further west, where at least three of the same species occur. The absence of the species *Nucula* (*Palæonucula*) *cuneiformis* J. de C. Sowerby and *Grammatodon* (*Indogrammatodon*) *egertonianus* (Stoliczka), which occur so abundantly at about the same horizon in the Aden hinterland and in Somaliland, has probably been determined by a difference in facies. It is of interest to note that the affinities of the assemblage described in the present paper are predominantly European, whereas the *N. cuneiformis*–*G. egertonianus* assemblage is restricted to the Indo-African province.

The specimens now described, like those collected on his previous expeditions, have been generously presented by Mr. Philby to the Department of Geology of the British Museum (Natural History).

DESCRIPTION OF THE SPECIES.

Class LAMELLIBRANCHIA.

Navicula (*Eonavicula*) cf. *quadrisulcata* (J. de C. Sowerby). (Pl. XII. fig. 7.)

Compare :—

Arca quadrisulcata J. de C. Sowerby, 1824, vol. v. p. 115, pl. ccccxxiii. fig. 1.
Arca quadrisulcata P. de Loriol, 1875, p. 145, pl. xviii. figs. 7, 8.
Navicula (*Eonavicula*) *quadrisulcata* W. J. Arkell, 1929, p. 36, pl. i. figs. 3–5.

Material.—One specimen.

Description.—This specimen is the internal cast of a well inflated, moderately elongate, trapezoidal shell with subparallel dorsal and ventral margins, and broad, prominent, and rather widely separated umbones placed at about the anterior quarter of its length. A sharp carina in each valve coincides with the most inflated region of the shell and delimits a broad posterior area on which the impressions of radial sulci, three or four in number, are faintly visible. The anterior end of the ventral margin of the cast is broken away, so that it is impossible to say if there was any sinus or gape of the valve-margins in this region. No distinct impressions of hinge-teeth are preserved.

Dimensions.—Length 38·8 mm., height 19·5 mm., inflation 20·2 mm.

Remarks.—This cast has the characteristic shape of a *Navicula* and may be referred without hesitation to its Jurassic subgenus, *Eonavicula*. It agrees very well with many British specimens of the Argovian species *N. quadrisulcata*—a form which, like other representatives of its genus, varies considerably in outline and inflation. Dr. W. J. Arkell (*loc. cit.*) includes *Arca* (*Macrodon*) *cepha* de Loriol (1893, p. 276, pl. xxx. figs. 6–11), from the Upper Argovian (Rauracian) of the Bernese Jura, in the synonymy of *N. quadrisulcata*, but excludes certain forms from the Upper Jurassic of various European localities which differ from that species in having only three radial sulci instead of four on the posterior area. In some British specimens, however, a fourth sulcus is only very faintly indicated, and I doubt if the forms with only three sulci are specifically distinct from *N. quadrisulcata*.

It is impossible to say definitely if the sulci on the specimen now described numbered three or four, but the latter seems the more probable number.

In Europe *N. quadrisulcata* has been recorded from the Argovian and Lower Kimmeridgian (Sequanian). A closely related form occurs in the English Portlandian, and bears the name *N. dorsetensis* Cox (1925, p. 127, pl. i. figs. 7 *a*, *b*, and pl. ii. figs. 1 *a*, *b*, 2, *sub Parallelodon*).

No closely related species has previously been recorded from the Jurassic of Arabia or adjacent regions. "*Arca*" *sublata* d'Orbigny, which K. Futterer (1897, p. 598, pl. xxi. figs. 1, 1 *a*) figures from the Upper Jurassic of Shoa (Ethiopia) and Mlle. E. Basse (1930, p. 139) records from the Yemen, is easily distinguishable, as its carina is less well-defined and its most inflated region lies within the anterior half of its length, and thus considerably anterior to the carina. The internal cast of the well-known species *Grammatodon* (*Indogrammatodon*) *egertonianus* (Stoliczka) *, which occurs in the Kimmeridgian of the Aden hinterland, as well as in India, Somaliland, and elsewhere, differs in the same characters as distinguish "*Arca*" *sublata*, from which it is itself distinguished by its more inflated form.

Modiolus jurensis (Merian MS., Roemer).

Mytilus jurensis Merian MS., F. A. Roemer, 1836, p. 89, pl. iv. fig. 10.
Mytilus jurensis L. R. Cox, 1935, p. 161, pl. xv. figs. 15–17.

Material.—One specimen.

Remarks.—The specimen is an internal cast which is broken at its postero-ventral extremity, but otherwise agrees fairly well with one of the specimens from Somaliland figured by me (fig. 16) in the above-cited paper. The question of the generic allocation of this well-known Argovian–Kimmeridgian species has been discussed by me in another recent paper (1937 *b*, p. 342).

Brachidontes (*Arcomytilus*) *subpectinatus* (d'Orbigny). (Pl. XII. fig. 4.)

Mytilus pectinatus J. Sowerby, 1821, vol. iii. p. 147, pl. cclxxxii (non *Modiola pectinata* J. B. de Lamarck, 1805, which is also referable to *Brachidontes*).
Mytilus subpectinatus A. d'Orbigny, 1850, p. 340.

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* For a discussion of the generic affinities of this species, which has been usually referred to *Parallelodon*, see L. R. Cox, 1937 *a*.

Mytilus subpectinatus P. de Loriol, 1872, p. 341, pl. xix. fig. 6.
Mytilus (*Arcomytilus*) *pectinatus* W. J. Arkell, 1929, p. 53, pl. ii. fig. 9; also 1935 (Additional Notes), p. viii.
Mytilus subpectinatus E. Basse, 1930, p. 138, pl. v. fig. 10.

Material.—Two specimens.

Description.—These specimens are casts bearing traces of the radial threads which ornament the shell in this species. One specimen broadens considerably in a postero-ventral direction and has a wide, flattened postero-ventral margin, thus agreeing well with the type-form of the species as found in the English Argovian. The other specimen (Pl. XII. fig. 4), however, is more parallel-sided, with the margin in question more rounded; it therefore shows some approach to "*Mytilus*" *laitmairensis* de Loriol *, which may be merely a variety of *subpectinatus*. In both specimens, however, the ridges which pass from the umbo to the extremities of the postero-ventral margin are well defined, whereas in the typical *laitmairensis* they are absent.

Remarks.—I intend to discuss elsewhere the internal characters of this species, which is the type of *Arcomytilus* Agassiz. The ribbed forms of the Jurassic appear to be the ancestors of the Recent ribbed forms which are included in the genus *Brachidontes*, and I therefore regard *Arcomytilus* as a subgenus of *Brachidontes*.

B. pectinatus is a well-known species which is widely distributed in beds of Argovian and Lower Kimmeridgian age.

Pteroperna modiolaris (Münster).
(Pl. XII. fig. 1.)

Avicula modiolaris G. v. Munster, 1836, in A. Goldfuss, p. 131, pl. cxviii. fig. 5.
Avicula modiolaris F. A. Roemer, 1836, p. 87, pl. v. fig. 1.
Avicula gessneri J. Thurmann MS., A. Gressly, 1840, p. 136 (*nom. nud.*).
Avicula gesneri C. Contejean, 1858, p. 74.
Avicula gesneri C. Contejean, 1859, p. 300, pl. xix. figs. 8, 9.
Avicula modiolaris C. Contejean, 1859, p. 301.
Avicula gesneri J. Thurmann and A. Étallon, 1862, p. 229, pl. xxx. fig. 5.
Avicula gessneri P. de Loriol, 1872, p. 363, pl. xx. figs. 5, 6.
Avicula gessneri E. Greppin, 1894, p. 70, pl. iv. fig. 20.
Avicula cf. *gessneri* K. Futterer, 1897, p. 589, pl. xix. fig. 8.
Avicula cf. *gessneri* E. Basse, 1930, p. 136.
Avicula (*Pteroperna*) *gessneri* V. Pcelincev, 1928, p. 485.

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* See L. R. Cox, 1935, p. 164, pl. xv. figs. 13, 14; also W. J. Arkell, 1936, p. 359, pl. liii. fig. 2.

Material.—One specimen.

Description.—The specimen which I refer to this species is an exceptionally clear natural mould of the exterior of the shell preserved in a nodular coral-growth. The details of the surface ornamentation are well preserved on the dorsal portion of the specimen, but are more obscure on the ventral region, where, apparently, the specimen had suffered some decortication before leaving its impression. A plaster cast made from this natural mould is figured.

The specimen is a large and strongly inflated left valve whose length is slightly in excess of its height. The posterior wing is broad, acutely pointed, and of moderate length, with a strongly concave posterior margin; the anterior wing, which is also sharply pointed, is fairly small. The body of the shell is narrow at the umbo, which is not at all incurved. In the earlier stages of growth it is only moderately oblique, its median line making an angle of about 60° with the hinge-margin. In later stages of growth, however, the body curves round strongly in a posterior direction, so that its median line becomes horizontal before reaching the posterior extremity of the shell; this extremity, which is rather pointed, projects considerably beyond the tip of the posterior wing. The level of the body declines rather gradually towards the posterior wing, which is less flattened than in many species; on the other side it falls away more steeply towards the anterior wing, which does not appear to be delimited by a definite groove. About seven unevenly spaced, strong, narrow radial ribs are present on the dorsal region of the body, but appear to become weaker in later stages of growth; fine concentric threads ornament the interspaces. The posterior wing bears four ridges parallel to the hinge-margin; these are separated by well-defined depressions.

The valve margins of the shell do not lie in a plane, the postero-ventral region being slightly twisted towards the right-hand side of the shell—that is, away from the observer when viewing the exterior of the left valve. The right valve would appear therefore to have been decidedly smaller than the left.

Dimensions.—Length 66·5 mm., height 54·5 mm., inflation 20·0 mm.

Remarks.—The only specimens of this species available to me for comparison are, like the original specimens figured by Goldfuss and Roemer, internal casts from the German Kimmeridgian. In interpreting the species I have, therefore, been obliged to rely mainly upon the figures published by Contejean, Thurmann and Étallon, and de Loriol, which alone give a satisfactory idea of the external characters of the shell. Its internal characters are unknown, but the presence of the horizontal ridges on its posterior wing indicates that it should be referred to the genus *Pteroperna*. The left valves figured by Contejean and by Thurmann and Étallon have a straighter and more oblique body and a more rounded postero-ventral extremity than the one now described. The specimen figured by de Loriol, however, agrees more closely in these characters; it differs mainly in the greater area of its posterior and anterior wings, due to the fact that the marginal sinus below each of these wings is less pronounced. The species is obviously somewhat variable, so that these differences are probably of no significance. Its rather strongly inequivalve character is shown in the figures published by the authors cited, while its slightly twisted postero-ventral extremity is indicated by Thurmann and Étallon.

The Bathonian species *Pteroperna costatula* (J. A. Eudes-Deslongchamps) * is very similar to the species now recorded, but the body of its shell is straighter, narrower, and more oblique, and its posterior wing is narrower. Specimens from the *Mytilus*-beds of the Alps of Vaud (Switzerland), the age of which is still a matter for dispute, have been referred to *Pt. costatula* by P. de Loriol (1883, p. 64, pl. xi. fig. 1); these agree more closely with the specimen now described than do English and French Bathonian specimens of the species.

Pt. modiolaris is more usually known by the trivial name *gessneri*, but if the synonymy given above is accepted it is obvious that this name cannot be retained. *Avicula modiolaris* J. de C. Sowerby, an Upper Carboniferous species now usually referred to *Naiadites*, was not described until 1840, and so does not invalidate Münster's name. The species is widely distributed in the Kimmeridgian of Europe, where it appears to be most abundant in the Sequanian. Futterer has figured a possible representative from Shoa (Ethiopia), while Mlle. E. Basse has recorded it from the Yemen.

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* J. A. Eudes-Deslongchamps, 1824, p. 131, pl. v. figs. 3–5 (*sub Gervillia*); also J. Morris and J. Lycett, 1853, p. 18, pl. ii. figs. 8, 13.

Entolium cf. *demissum* (Phillips).

Compare :—

Pecten demissus J. Phillips, 1829, p. 140, pl. vi. fig. 5.
Entolium demissum W. J. Arkell, 1930, p. 91, pl. vii. fig. 4, and pl. ix. fig. 8.

Material.—One specimen.

Remarks.—This specimen, which is broken away dorsally, is mainly an internal cast, but retains a little of the original shell. It appears to be referable to *E. demissum*, as interpreted by Arkell to include in its synonymy *Pecten vitreus* Roemer and *P. solidus* Roemer. This species ranges in Europe from the Callovian to the Kimmeridgian or, possibly, to the Lower Portlandian.

Lima (*Plagiostoma*) aff. *harronis* Dacqué.

[*Lima harronis* E. Dacqué, 1905, p. 133, pl. xv. figs. 13, 14.]
Lima (*Plagiostoma*) cf. *astartina* Thurmann ; J. Weir, 1929, p. 27, pl. ii. figs. 7–11.
Lima (*Plagiostoma*) *harronis* L. R. Cox, 1935, p. 179, pl. xix. figs. 2, 3.

Material.—One specimen.

Description.—This specimen, which is partly broken, is a highly inequilateral and oblique, medium-sized right valve, about 36 mm. in height. Its outline is pronouncedly trapezoidal, as the anterior umbonal ridge is straight and considerably produced, with the postero-ventral margin subparallel to it. The ornamentation consists of over fifty depressed, rounded radial riblets, which are separated by punctate linear interspaces.

Remarks.—This specimen bears a very close resemblance to the species from the Upper Jurassic of British Somaliland which J. Weir figures under the name *Lima* (*Plagiostoma*) cf. *astartina* Thurmann, and which I, in a previous paper, have considered to be identical with *L.* (*P.*) *harronis* Dacqué. This assignation may be correct, although it cannot be regarded as definitely substantiated until it has been possible to study a series of specimens of *L. harronis* from its type horizon and locality, the Lower Kimmeridgian of Ethiopia, showing the full range of variation. The type-specimen, as figured by Dacqué, is smaller than those from British Somaliland, and has narrower and more numerous ribs.

L. astartina (Contejean, 1859, p. 308, pl. xxiii. figs. 3–5), a species of the European Kimmeridgian, closely resembles the specimen now recorded and those from Somaliland in ornamentation, but its anterior umbonal ridge is less produced. The species *L. acutirostris* Krumbeck (1905, p. 97, pl iii figs. 2 *a–c*), from the Kimmeridgian of Syria, is also comparable in ornamentation, but differs to some extent in shape.

Lucina sp. indet. (Pl. XII. fig. 2.)

Material.—Five specimens.

Description.—These specimens are all somewhat eroded casts of an ovate and rather feebly inflated *Lucina* whose length is slightly in excess of its height. The umbo, which is very slightly anterior to median, is not at all prominent; the even curve of the outline of the cast is interrupted by only a slight concavity in front of the umbo

Dimensions.—The measurements of a typical specimen are as follows :—Length 35 mm., height 30 mm.

Remarks.—These casts differ from the original type of *Lucina substriata* Roemer (1836, p. 118, pl. vii. fig. 18), a species which Mlle. E. Basse (1930, p. 140) records from the Kimmeridgian of the Yemen, in their less prominent umbo, but they bear a closer resemblance to *L. elsgaudiæ* Contejean (1859, p. 269, pl. xii. figs. 3–5), which P. de Loriol (1867, p. 63) regards as a synonym of *L. substriata*. They are not, however, well enough preserved for even a qualified specific name to be associated with them.

Lucina sp. n. (Pl. XII. fig. 3.)

Material.—One specimen.

Description.—The internal cast of an elongate-ovate, feebly inflated *Lucina*, with obtusely rounded, depressed umbones placed slightly anterior to the middle of the length. The even curve of the outline of the cast is interrupted by only a slight concavity in front of the umbo. The ventral margin is strongly and somewhat asymmetrically convex, ascending steeply anteriorly, so that the anterior end of the shell is rather narrow.

Dimensions.—Length 49·5 mm., height 37·0 mm., inflation 16·4 mm.

Remarks.—Although indifferently preserved this specimen is of interest as differing considerably in shape from any Jurassic *Lucina* whose description I can find in the literature. Perhaps the species *L. ingens* Buvignier (1852, p. 11, pl. x. figs. 3–5), from the "Coral-Rag" of the Meuse Département of France, is as close to it as any such species, but is less elongate and more regularly ovate in outline.

Corbis cf. *subdecussata* Buvignier.

(Pl. XII. fig. 5.)

Compare :—

Corbis subdecussata A. Buvignier, 1852, p. 13, pl. xi. figs. 20–23.
Corbis subdecussata W. J. Arkell, 1934, p. 288, pl. xxxvii. fig. 2.

Material.—Four specimens.

Description.—These are internal casts of a subrectangular species of *Corbis* of moderate inflation. The umbones, which are not very prominent, are placed very near the middle of the length. The ventral margin is feebly convex, ascending to a slight extent posteriorly; the posterior margin is rather sharply convex, the anterior margin flattened and subvertical. The pallial line, which is rather distant from the ventral margin, and the dorsally placed, subequal adductor scars, are clearly visible. Between the pallial line and the ventral margin the surface of the cast shows a delicate radial frilling. One specimen shows, in addition, a crenulation of the ventral margin.

Dimensions.—The measurements of the most complete specimen are as follows:—Length 52·7 mm., height 37·5 mm., inflation 27·2 mm.

Remarks.—The specimens now recorded undoubtedly belong to a group of Upper Jurassic species of *Corbis*, several representatives of which, from the "Coral-Rag" of St. Mihiel, in the Meuse Département of France, are described by A. Buvignier (1843 and 1852). Of Buvignier's species (some of which, probably, will eventually be united in synonymy) *C. subdecussata* appears to resemble the Arabian casts most closely, as the outline of its shell is pronouncedly rectangular. *C. decussata* Buvignier (1843, p. 228, pl. iii. figs. 15–17; 1852, p. 13, pl. xii.

figs. 7–11) is also very similar, but more ovate in outline. Another closely comparable species, which has been frequently cited in the literature, is *C. subclathrata* Thurmann MS., Contejean (1859, p. 273, pl. xiii. figs. 5–9; also J. Thurmann and A. Étallon, 1862, p. 186, pl. xxiii. fig. 1); this is probably a synonym of *C. decussata*, and, like that form, is more ovate in outline than the casts now recorded. An internal cast of *C. subclathrata*, which is represented in Contejean's fig. 6, closely resembles the specimens now recorded in the position of its adductor scars and pallial line.

A specimen from the Kimmeridgian of Shoa (Ethiopia) has been figured by K. Futterer (1897, p. 600, pl. xxi. figs. 2, 2 *a*) under the name *Fimbria subclathrata*; as Mlle. E. Basse (1930, p. 141) has pointed out, however, this specimen like a similar one figured by E. Dacqué (1905, p. 138, pl. xv. figs. 16 *a*, *b*), appears to be an internal cast of the species *Cardium bannesianum* Thurmann MS., Contejean.

Mactromya sp. indet. (Pl. XII. fig. 6.)

Material.—One specimen.

Description.—The internal cast of a medium-sized, moderately elongate, strongly inflated, almost symmetrical, ovate *Mactromya* with prominent, broadly rounded, almost median umbones. The ventral margin and the anterior margin are both rather flattened; the posterior margin is feebly convex.

Dimensions.—Length 42·0 mm., height 33·0 mm., inflation (approximate) 30·0 mm.

Remarks.—In shape this species agrees more closely with *Mactromya cardioides* (Phillips), of the Lias, than with any other described *Mactromya*. The most closely comparable Upper Jurassic representative of the genus which has hitherto been described appears to be *Mactromya crassa* Agassiz, as figured by L. Rollier (1913, p. 218, pl. xv. fig. 6); in that form, however, the shell appears to be higher at its posterior end than in the cast now recorded. Other Upper Jurassic species with which comparison may be made are the English Portlandian form recorded by me (1925, p. 152, pl. iii. fig. 1) under the name *Unicardium verioti* (Buvignier) and the French Kimmeridgian form recorded by P. de Loriol

(1872, p. 254, pl. xv. fig. 8) as *Unicardium excentricum* d'Orbigny; in both of these species, however, the shell is more inequilateral than the cast now recorded.

Cardium bannesianum Thurmann MS., Contejean.

Cardium bannesianum Thurmann MS., C. Contejean, 1858, p. 56.
Cardium bannesianum C. Contejean, 1859, p. 276, pl. xv. figs. 1–5.
Cardium banneianum J. Thurmann and A. Étallon, 1862, p. 181, pl. xxii. figs. 1 *a*, *b*.
Cardium banneianum P. de Loriol, 1872, p. 249, pl. xv. figs. 1, 2.
Cardium banneianum K. Futterer, 1897, p. 600.
Cardium banneanum E. Basse, 1930, p. 140, pl. v. fig. 8.

Material.—Two specimens.

Remarks.—These specimens, although broken, undoubtedly belong to this well-known Kimmeridgian species, which has been recorded by K. Futterer from Ethiopia and by Mlle. E. Basse from the Yemen.

Ceratomya excentrica (Voltz MS., Roemer).

Isocardia excentrica Voltz MS., F. A. Roemer, 1836, p. 106, pl. vii. fig. 4.
Ceromya excentrica L. Agassiz, 1842, p. 28, pls. viii. *a*, viii. *b*, viii. *c*.
Ceromya excentrica P. de Loriol, 1872, p. 199, pl. xii. figs. 12, 13.
Ceromya excentrica K. Futterer, 1897, p. 608, pl. xxii. figs. 2, 2 *a*.
Ceromya excentrica L. Krumbeck, 1905, p. 122, pl. v. figs. 13 *a*, *b*.
Ceratomya excentrica J. Weir, 1929, p. 31, pl. iii. fig. 4.

Material.—Six specimens.

Remarks.—These specimens are in every way characteristic of this well-known species and need no detailed description. In Europe the species appears in the Argovian, but is most abundant in the Kimmeridgian. A closely comparable species, *C. plicata* (Agassiz), occurs, however, in the Bathonian and Callovian. The specimens from the Callovian of the Tuwaik plateau, in Central Arabia, which were collected by Mr. Philby on a previous expedition and recorded by me (1933, p. 384) as *C. excentrica*, would, perhaps, have been preferably determined as *C. plicata*.

Class GASTROPODA.

Globularia cf. *hemisphærica* (Roemer).

Compare:—

Natica hemisphærica F. A. Roemer, 1836, p. 156, pl. x. fig. 7.
Natica hemisphærica P. de Loriol, 1872, p. 118, pl. viii. figs. 4–6.
Natica hemisphærica K. Futterer, 1897, p. 613,

Natica hemisphærica E. Basse, 1930, p. 142.
Globularia hemisphærica L. R. Cox, 1935, p. 155, pl. xiv. figs. 2 *a*, *b*.

Material.—One specimen.

Remarks.—This specimen is an internal cast which agrees well in shape with the figures cited above. It measures 23 mm. in both height and diameter, and hence, if its reference to *G. hemisphærica* is correct, is not full-grown. *G. hemisphærica* is a well-known Kimmeridgian species, already recorded from Ethiopia, Somaliland, and the Yemen.

Nerinea sp. indet.

Material.—One specimen.

Remarks.—A much eroded internal cast of a medium-sized species with strongly concave whorls. It is quite indeterminate.

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EXPLANATION OF PLATE XII.

(All figures are of natural size.)

Upper Jurassic Lamellibranchia from Southern Arabia.

Fig. 1. *Pteroperna modiolaris* (Münster). Plaster cast made from natural mould (Brit. Mus. L. 70321).
Fig. 2. *Lucina* sp. indet. (Brit. Mus. L. 70324).
Fig. 3. *Lucina* sp. n. (Brit. Mus. L. 70331).
Fig. 4. *Brachidontes* (*Arcomytilus*) *subpectinatus* (d'Orbigny) (Brit. Mus. L. 70318).
Fig. 5. *Corbis* cf. *subdecussata* Buvignier (Brit. Mus. L. 70332).
Fig. 6. *Mactromya* sp. indet. (Brit. Mus. L. 70336).
Fig. 7. *Navicula* (*Eonavicula*) cf. *quadrisulcata* (J. de C. Sowerby) (Brit. Mus. L. 70316).

XLII.—*New or little-known* Tipulidæ (*Diptera*).—LIV. *Neotropical Species.* By CHARLES P. ALEXANDER, Ph.D., F.R.E.S., Massachusetts State College, Amherst, Massachusetts, U.S.A.

AT this time I am describing a series of crane-flies from the Oriente of Ecuador, collected by William Clarke-Macintyre and his native collectors, the family of Elias Velastegui. Most of the specimens were taken at Abitagua on the Rio Pastaza, evidently a very prolific locality for this group of Diptera. The references cited below * give an idea of the conditions obtaining in this part of the Oriente. I am greatly indebted to Mr. Clarke-Macintyre and collectors for the opportunity of studying this extensive series of Tipulidæ. The types are preserved in my collection.

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TANYPREMNA Osten-Sacken.

1886. *Tanypremna* Osten-Sacken, Biol. Centrali-Americana, Dipt. i. p. 19.

LIMONIODES, subgen. nov.

Characters as in the typical subgenus, differing as follows :—Antennæ 13-segmented ; segments simple, with long verticils. Claws toothed. Wings (fig. 1) with distal section of vein R_{1+2} entirely atrophied so the radial field is almost exactly as in the genus *Limonia* (compare figs. 1 and 4) ; *Rs* long, arcuated, about three times *m–cu*. Microtrichia present in most cells beyond cord, especially near veins ; in basal cells lacking or virtually so.

Type of subgenus, *Tanypremna* (*Limoniodes*) *sulphurella*, sp. n. (Neotropical).

The present fly is somewhat similar to the subgenus *Tanypremnodes* Alexander (type, *leucoplaca*) in the complete atrophy of vein R_{1+2}, but differs conspicuously in the simple antennæ and great reduction in number of microtrichia in the cells before cord of wing. The venation of the radial field is amazingly like that of species of the genus *Limonia* Meigen, and there can be no question of the homologies of the veins. This shows that the distal end of the main radial vein consists of the free tip of Sc_2 and that the atrophied element is R_{1+2}. The methods by which this peculiar condition has been attained have been discussed by the present writer in various papers, the most recent being in the section on the Tipulidæ in Curran's 'Families and Genera of the North American Diptera,' pp. 38–39 (1934).

Tanypremna (*Limoniodes*) *sulphurella*, sp. n.

General coloration of notum chestnut-brown ; pleura with a transverse darkened girdle ; front wide, silvery ; legs with the genua restrictedly brightened ; tibial tips narrowly whitish ; outer tarsal segments dirty white ; wings sulphur-yellow, the stigma not or scarcely defined ; abdominal segments ringed with yellow at near mid-length.

Male.—Length about 14–15 mm. ; wing 11–12 mm. ; antennæ about 1 mm.

Frontal prolongation of head very short, black ; palpi black. Antennæ with the scape and pedicel yellow, flagellum black. Front and anterior vertex wide, conspicuously silvery; posterior sclerites of head abruptly dark brown, the genæ paling to yellow.

Pronotum obscure yellow. Mesonotum almost uniformly chestnut-brown, the præscutum darker brown on sides before suture; præscutal setæ very small and reduced in number; scutal lobes darker brown; scutellum paler, more testaceous brown; mediotergite brown, the anterior third darker. Pleura yellow, conspicuously banded transversely with dark brown, including a complete girdle on mesepisternum, including the dorsopleural membrane, anepisternum and sternopleurite; pleurotergite similarly darkened, the propleura and the pteropleurite remaining of the ground-colour. Halteres brownish black throughout. Legs with the coxæ and trochanters greenish testaceous; femora restrictedly pale basally, the remainder black with the extreme tips greenish white; tibiæ black, the extreme bases and slightly wider tips greenish white, this more extensive on posterior legs; basitarsi black, the outer ends and remainder of tarsi dirty brownish white, most conspicuous on fore legs. Wings (fig. 1) with a strong sulphur-yellow tinge; stigma scarcely indicated by a faint darkening; in cases wing-tip narrowly darkened; veins black. Strong macrotrichia on distal ends of veins beyond cord. Venation as discussed under the subgenus; Sc_1 entire; cell 1*st* M_2 large, widest across base; petiole of cell M_1 subequal to or shorter than *m*; *m–cu* at near two-thirds the length of M_{3+4}. In one paratype specimen *r-m* in both wings is obliterated by a relatively long fusion of veins R_{4+5} and M_{1+2}.

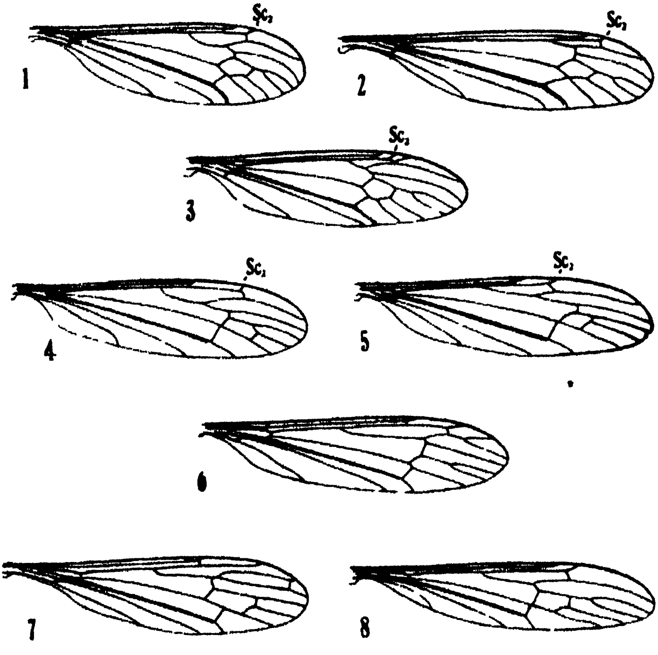
Abdomen elongate, tricoloured, the segments brownish black apically, more reddish basally, with a narrow, more yellowish to nacreous ring at near mid-length; hypopygium dark brown. Male hypopygium with the tergite relatively extensive, the caudal margin broadly emarginate. Basistyle elongate. Outer dististyle a little longer than the inner, narrowed to a slender apex. Inner dististyle elongate, terminating in a slender beak that is shaped more or less like a pruning-knife; surface of style with about twenty-five conspicuous black spinous setæ.

Hab. Ecuador (Oriente).

Holotype, ♂, Abitagua, altitude 1200 metres, April 3, 1937 (*Macintyre*).

Paratopotypes, 5 ♂♀, April 4–18, 1937.

Tanypremna (*Limoniodes*) *sulphurella* is very different from all members of the genus so far described. The radial sector is longer and more arcuated than in any other known species.



Venation of Tipulidæ from Ecuador.

Fig. 1.—*Tanypremna* (*Limoniodes*) *sulphurella*, sp. n.
Fig. 2.—*Tanypremna* (*Tanypremnella*) *crystallina*, sp. n.
Fig. 3.—*Tanypremna* (*Tanypremna*) *carbonipes*, sp. n.
Fig. 4.—*Limonia* (*Limonia*) *velasteguii*, sp. n.
Fig. 5.—*Protohelius cisatlanticus*, sp. n.
Fig. 6.—*Hexatoma* (*Eriocera*) *patens*, sp. n.
Fig. 7.—*Elephantomyia* (*Elephantomyina*) *supernumeraria* Alexander.
Fig. 8.—*Trentepohlia* (*Promongoma*) *mirabilis*, sp n.

TANYPREMNELLA, subgen. nov.

Characters as in the typical subgenus, differing as follows :—Antennæ 10-segmented in both sexes, elongate in male ; flagellar segments cylindrical, with abundant erect setæ scattered over the entire segment, exceeding in length the sparse verticils. Tibial spurs on all legs; claws toothed. Wings (fig. 2) without microtrichia on basal four-fifths of wing, present in outer ends of cells beyond cord. Venation: Sc_1 preserved; R_{1+2} atrophied, the combined vein R_1 and R_2 weakly angulated, in alignment with the short transverse free tip of Sc_2; *Rs* short but longitudinal in position, a little more than one-half R_{2+3}; cell 1*st* M_2 large, irregularly pentagonal to hexagonal, widest opposite *r–m*; vein Cu_2 lying far from Cu_1. Male hypopygium with the ninth tergite transverse, the caudal margin truncate or convexly rounded, not notched. Inner dististyle oval to subcircular in outline. Ovipositor with relatively short fleshy cerci, with setæ scattered over the entire length.

Type of subgenus, *Tanypremna* (*Tanypremnella*) *crystallina*, sp. n. (Neotropical). *T.* (*T.*) *transfasciata*, sp. n., likewise belongs here.

This new subgeneric group is closest to the subgenus *Limoniodes*, differing especially in the 10-segmented antennæ, which are of an unusual length for a member of this genus. Both groups have R_{1+2} atrophied, but the present fly shows the point of departure represented by a slight angulation where R_1 and R_2 unite. The great reduction in number of microtrichia on the wing-surface of both of these groups is not found in the five other subgeneric groups now placed in *Tanypremna*.

Tanypremna (*Tanypremnella*) *crystallina*, sp. n.

General coloration yellowish brown, the pleura with an ill-defined transverse brown girdle; antennæ (male) of moderate length, between one-third and one-fourth the length of body; wings crystal clear, the tip weakly darkened; *r–m* elongate; abdominal tergites conspicuously bicoloured.

Male.—Length about 9–10 mm.; wing 10·5–11·5 mm.; antenna about 2·5–3 mm.

Female.—Length about 9 mm.; wing 11 mm.; antenna about 1·2 mm.

Frontal prolongation of head short, yellowish brown; nasus distinct; palpi dark brown. Antennæ moderately elongate in male, short in female, as shown by measurements; scape and pedicel yellow, flagellum black; flagellar segments gradually decreasing in length outwardly, the last shortest. Head dark grey, the centre of anterior vertex and posterior border of occiput more blackened; head beneath light yellow.

Pronotum moderately darkened. Mesonotal præscutum yellowish brown, with indications of three slightly darker brown nitidous stripes; scutum and scutellum dark brown the parascutella and postnotum a little paler. Pleura and pleurotergite yellow, the mesepisternum with an ill-delimited brown transverse girdle, occupying the dorsopleural membrane and anterior portion of the anepisternum and sternopleurite. Halteres elongate, black, the base of stem restrictedly pale. Legs with the coxæ and trochanters yellow; femora dark brown; tibiæ brownish black, the tips broadly snowy-white, narrowest (about distal seventh or eighth) on fore legs, widest (about distal fourth or fifth) on posterior pair; basitarsi brownish black, on about the distal fourth (fore legs) to half (posterior legs) snowy-white, the remaining segments similarly whitened. Wings (fig. 2) almost crystal clear, the tip weakly darkened, the colour produced, in part at least, by the microtrichia; the large stigma and cell *Sc* dark brown; veins black. Macrotrichia numerous and well distributed on longitudinal veins beyond cord. Venation: as defined under the subgenus; *m–cu* shortly before fork of M_{3+4}, the position slightly variable; *r–m* elongate, from two-thirds the length to subequal to basal section of R_{4+5}.

Abdominal tergites conspicuous bicolorous, brownish black, ringed on basal third or more with yellow, the amount of the latter decreasing on outer segments, least on segments six and seven; segment eight entirely black; hypopygium yellow; sternites more uniformly yellow, only the intermediate segments bicoloured. Male hypopygium with the caudal margin of tergite truncate on central portion, the sides broadly rounded.

Hab. Ecuador (Oriente).

Holotype, ♂, Abitagua, altitude 1200 metres, April 20, 1937 (*Macintyre*). *Allotopotype*, ♀, pinned with type. *Paratopotypes*, several, chiefly ♂♂, April 2–21, 1937.

This handsome fly requires comparison only with the species next defined.

Tanypremna (Tanypremnella) transfasciata, sp. n.

Male.—Length about 9 mm.; wing 10·2 mm.; antennæ about 6·5 mm.

Differs from *T. (T.) crystallina*, sp. n., as follows:—

Frontal prolongation of head orange, the nasus very short and obtuse. Antennæ very long, in male exceeding two-thirds the length of body, as shown by the measurements, the segments gradually decreasing in length outwardly. Head orange-yellow, vaguely darkened medially behind.

Pronotum larger, conspicuously dark brown medially, abruptly pale yellow on sides. Mesonotum bright yellowish-brown. Pleura pale yellow, with a very conspicuous, clearly delimited, dark brown girdle, extending from the lateral borders of the præscutum before the suture, occupying the entire mesepisternum and mesosternum. Femoral tips narrowly and abruptly darkened. Wings less darkened apically; *r–m* obliterated or virtually so by approximation and punctiform contact of vein R_{4+5} with M_{1+2}. Male hypopygium with the caudal margin of tergite more broadly truncated.

Hab. Ecuador (Oriente).

Holotype, ♂, Jatun Yacu, altitude 700 metres, March 1937 (*Macintyre*).

Tanypremna (Tanypremna) carbonipes, sp. n.

General coloration of mesonotum obscure yellow, the præscutum with four brown stripes; scutal lobes extensively blackened; pleura yellow, with a narrow transverse brown girdle; tibiæ and tarsi uniformly black; wings with a brownish yellow tinge, cells *C* and *Sc* more suffused yellow; stigma and conspicuous seams on cord dark brown; *Rs* gently arcuated; cell Sc_2 at margin relatively wide, the free tip of Sc_2 and vein R_1 beyond it subequal; cell 1*st* M_2 wide; abdominal tergites bicoloured, the basal half yellow, the outer half brown; subterminal segment more uniformly darkened.

Male.—Length about 18 mm.; wing 14 mm.

Female.—Length about 22 mm.; wing 14·5 mm.

Frontal prolongation of head yellow, short, with distinct nasus; palpi black. Antennæ with scape yellow, pedicel brownish yellow, flagellum black, the segmentation poorly indicated. Head yellow, more reddish on orbits; anterior vertex broad.

Mesonotal præscutum obscure yellow, with four brown stripes, the intermediate pair separated only by a capillary pale vitta; pseudosutural foveæ large, black; a circular black spot at lateral end of suture; scutum obscure yellow, the lobes extensively blackened; scutellum yellow; postnotum pale, the mediotergite darkened on central portion. Pleura yellow, with a narrow transverse brown girdle on mesepisternum, beginning as a narrow line near the pseudosutural foveæ, widened below, broadest on the sternopleurite; pleurotergite with a ventral darkening. Halteres pale, the knobs greenish. Legs with the coxæ and trochanters pale; femora yellow basally, passing into brown, the tips narrowly dark brown; tibiæ and tarsi black; claws relatively small, each with a conspicuous tooth. Wings (fig. 3) with a brownish yellow tinge, cells *C* and *Sc*, with the outer radial cells, more suffused yellow; stigma and confluent seams on cord dark brown; *Cu* and veins beyond cord vaguely seamed with dusky; veins dark, yellow in the costal portion. Venation: *Rs* gently arcuated, straight in *invaripes*; vein R_1 beyond the free tip of Sc_2 long, subequal to the latter element, in *invaripes* very short so cell Sc_2 is much narrower; cell *1st* M_2 wide, at mid-length only a little narrower than long, vein *m* subequal to the basal section of M_3; *m–cu* at near two-thirds the length of vein M_{3+4}.

Abdominal tergites bicoloured, the basal half yellow, the outer half brown, the subterminal segments more uniformly darkened; sternites more uniformly yellow, especially the seventh sternite in male; hypopygium chiefly darkened. Ovipositor with cerci straight, relatively slender.

Hab. Ecuador (Oriente).

Holotype, ♂, Abitagua, altitude 1200 metres, April 20, 1937 (*Macintyre*). *Allotopotype*, ♀, April 3, 1937.

The nearest ally of the present fly is *Tanypremna (Tanypremna) invaripes* Alexander (southern Brazil), which differs in the pattern of the mesonotum, pleura, and abdomen, and in the wing-pattern and venation, especially the outer radial field and cell *1st* M_2.

Limonia (*Limonia*) *macintyrei*, sp. n.

Belongs to the *eiseni* group; flagellar verticils of unusual length; a broad black dorsopleural stripe; legs slender, dark brown to black; wings tinged with brownish yellow, heavily patterned with brown, the areas at arculus and origin of *Rs* reaching costa in front; areas at fork of *Sc* and stigma forming a Y-shaped figure in conjunction with a conspicuous seam along cord: *Sc* long; male hypopygium with the mesal-apical lobe of gonapophysis a strongly curved black spine, the tip acute.

Male.—Length about 5–6 mm.; wing 5·5–7 mm.

Female.—Length about 5·5 mm.; wing 6·5 mm.

Rostrum and palpi black. Antennæ black throughout; flagellar segments oval, with short apical pedicels; verticils unusually long in both sexes, but more especially so in male, nearly one-fourth the length of the entire antenna, unilaterally distributed. Head black, the front and narrow anterior vertex light silvery grey.

Pronotum obscure yellow above, darkened laterally. Mesonotum chestnut-brown, without distinct markings excepting the still darker lateral margin of præscutum, scutal lobes, and scutellum; mediotergite dark, sparsely pruinose. Pleura obscure yellow, with a broad black longitudinal stripe extending from the cervical region, passing through base of halteres to abdomen; ventral sternopleurite less distinctly darkened, pruinose. Halteres infuscated, especially the knobs, the extreme base of stem restrictedly pale. Legs with the coxæ and trochanters yellow; remainder of legs long, dark brown to black. Wings tinged with brownish yellow, with a heavy brown pattern, as follows:—Postarcular, reaching costa; origin of *Rs*, reaching costa; fork of *Sc* and stigma, these areas converging behind to form a Y-shaped pattern along cord; outer end of cell 1*st* M_2 and marginal spots at ends of veins R_3, R_{4+5}, *Cu*, 1*st A*, and 2*nd A*, the last large; a dusky clouding in outer radial and medial fields and as a narrow axillary seam; a more or less distinct brown cloud in cell *M* adjoining vein *Cu*; veins pale, darker in the clouded areas. Venation: *Sc* long, Sc_1 ending shortly before level of fork of *Rs*, Sc_2 near its tip; *Rs* relatively long, angulated to nearly square at origin; nner end of cell 1*st* M_2 arcuated, lying far proximad of that of cell R_5; *m–cu* close to fork of *M*.

Abdominal tergites black, the incisures restrictedly paler; intermediate sternites chiefly obscure yellow, the caudal margins of the individual segments narrowly black; male hypopygium black, the small ventral dististyles abruptly white. Male hypopygium with the ventromesal lobe of basistyle relatively large. Ventral dististyle much smaller than the basistyle, the body small, semioval, the beak broadly compressed, as in the group; rostral spines two, short and pale, blunt at tips, placed close together on face of rostrum, surrounded by abundant delicate setulæ; at base of rostrum two exceptionally long, modified setæ. Dorsal dististyle lying in notch of the ventral, straight, the apex acutely decurved. Ædeagus nearly parallel-sided, the apex obtuse. Gonapophyses with mesal-apical lobe a strongly curved black spine, the tip acute.

Hab. Ecuador (Oriente).

Holotype, ♂, Abitagua, altitude 1200 metres, April 7, 1937 (*Macintyre*). *Allotopotype*, ♀. *Paratopotype*, 1 ♂, April 4, 1937.

I take very great pleasure in naming this distinct species in honour of Mr. William Clarke-Macintyre, through whose conscientious efforts our knowledge of the Tipulidæ of Ecuador has been vastly increased. From the other members of the *eiseni* group, including *caribæa* Alexander (Cuba), *eiseni* Alexander (Central America), and *indomita* Alexander (southern Brazil), the present species is most readily told by the nature of the wing-pattern and the structure of the male hypopygium, notably of the gonapophyses.

Limonia (*Limonia*) *velasteguii*, sp. n.

Belongs to the *eiseni* group; allied to *amazonica*; mesonotal præscutum reddish brown, with a darker brown median stripe, the lateral borders restrictedly darkened; wings patterned with brown; abdominal tergites bicoloured, the usual pattern reversed, the apices of the individual segments broadly yellow; male hypopygium with the rostral prolongation slender.

Male.—Length about 7 mm.; wing 7·8–8 mm.

Rostrum and palpi black. Antennæ black throughout; flagellar segments long-oval to subcylindrical, with short glabrous apical pedicels; longest verticils exceeding twice the length of the segments. Head black, the narrow front and anterior vertex, together with the orbits, grey.

Mesonotal præscutum reddish brown, with a darker brown median stripe, the extreme lateral borders, behind the pseudosutural foveæ, similarly darkened; posterior sclerites of notum dark brown. Pleura dark brown, the meral region paler. Halteres dusky, the extreme base of stem yellow. Legs with the coxæ dark brown, the tips narrowly paler; trochanters yellow; femora brownish yellow, with a narrow brown subterminal ring; tibiæ and tarsi brownish yellow, the terminal tarsal segments dark brown; claws with a slender appressed postmedian and a stouter basal spine. Wings (fig. 4) with a brownish tinge; stigma oval, darker brown; restricted brown clouds at origin of *Rs*, along cord and along outer end of cell *1st* M_2; veins dark brown. Venation: *Sc* relatively long, Sc_1 ending about opposite two-thirds the length of *Rs*, Sc_2 near its tip; *Rs* angulated to short-spurred at origin; cell *1st* M_2 about equal in length to vein M_3 beyond it; *m–cu* close to fork of *M*; cell *2nd A* relatively wide.

Abdominal tergites bicoloured, the basal half to two-thirds of the individual segments dark brown, the apices yellow, the amount of the latter decreasing on outer segments; hypopygium chiefly brownish yellow. Male hypopygium with the dorsal dististyle reduced. Ventral dististyle with the rostral prolongation produced into a narrow point. Gonapophyses with the mesal-apical lobes long, gradually narrowed to an obtuse point.

Hab. Ecuador (Oriente).

Holotype, ♂, Abitagua, altitude 1200 metres, April 18, 1937 (*Macintyre*). *Paratopotype*, ♂, April 2, 1937.

I am pleased to name this distinct fly in honour of the family of Elias Velastegui, native collectors for Mr. Clarke-Macintyre. The nearest described ally seems to be *Limonia* (*Limonia*) *amazonica* (Alexander) of Amazonian Brazil, which differs in the abdominal pattern and in the structure of the male hypopygium, notably the ventral dististyle. The paratype above-mentioned differs considerably in colour from the type, but seems undoubtedly to be conspecific. Both individuals show the reversal of pattern of the abdomen and agree closely in the structure of the male hypopygium. The paratype shows the femoral tips uniformly darkened and the wing-pattern much heavier and more extensive, especially the areas at origin of *Rs* and along the cord.

Protohelius cisatlanticus, sp. n.

General coloration brownish black; antennæ (male) about one-half the length of body; legs black, the tarsi paling to yellow; wings with a strong blackish tinge; R_{1+2} atrophied; *m–cu* close to fork of *M*.

Male.—Length about 6 mm.; wing 7 mm.; antennæ about 3 mm.

Rostrum and palpi black. Antennæ about one-half the length of body, 15-segmented, black throughout; flagellar segments cylindrical, beyond the first subequal in length; each segment with short strong verticillate setæ before mid-length. Head brownish black; eyes large.

Mesonotum dark brown, the scutellum and posterior portion of scutum a little paler. Pleura brown. Halteres dark brown, the base of stem obscure yellow. Legs with the coxæ and trochanters brownish yellow; femora and tibiæ black; tarsi paling to yellow; claws simple. Wings (fig. 5) with a strong blackish tinge; veins brownish black. Macrotrichia on veins beyond cord, more sparse and scattered on M_4. Venation: Sc_1 ending about opposite four-fifths the length of *Rs*, Sc_2 some distance from tip; *Rs* straight, in alignment with the long basal section of R_{4+5}; R_{1+2} atrophied; R_2 pale but distinct, subequal in length to R_{1+2}; inner end of cell 1*st* M_2 arcuated so *r–m* is beyond mid-length of the cell; veins issuing from cell 1*st* M_2 long; *m–cu* close to fork of *M*.

Abdomen, including hypopygium, brownish black; surface of abdomen with conspicuous erect setæ. Male hypopygium with the dorsal dististyle blackened, curved, with a small lateral spine on lower margin at point of curvature; ventral dististyle more slender and a little longer, yellow, with a long blackened lobe on basal fourth of lower face, this provided with about four very long conspicuous setæ.

Hab. Ecuador (Oriente).

Holotype, ♂, Abitagua, altitude 1200 metres, November 6, 1936 (*Macintyre*).

The discovery of a species of the genus *Protohelius* in the New World is of exceptional interest, the two species hitherto described, *P. issikii* Alexander and *P. tinkhami* Alexander, being from eastern Asia. The present fly is of unusual significance in that it illustrates the manner in which the venation of the genus *Helius* may have been derived from more generalized types by the successive atrophy of veins R_{1+2} and R_2. This is well illustrated by the genus *Electrolabis* Alexander (Lower Oligocene: Baltic Amber) *, which seems undoubtedly to be the ancestral type from which *Protohelius* has been derived. In the Old World species of the genus, both R_{1+2} and the free tip of Sc_2 are preserved †, but in the present fly one of these elements has atrophied. I am interpreting the persistent vein as being the free tip of Sc_2, and thus assume that R_{1+2} has entirely atrophied. It should be noted further that vein R_2 is paler and weaker than usual, and is evidently in process of atrophy.

Hexatoma (*Eriocera*) *patens*, sp. n.

Size small (wing, male, 6 mm.); antennæ (male) relatively long, exceeding one-half the length of body; mesonotum polished black, the pleura and pleurotergite obscure yellow; halteres dark brown; wings with a brown tinge, unmarked; abundant macrotrichia on all outer veins of wing; cell R_3 short; cell *1st* M_2 open by atrophy of basal section of M_3; abdominal tergites and hypopygium black.

Male.—Length about 5·5 mm.; wing 6 mm.; antennæ 3 mm.

Rostrum short, brown; palpi black. Antennæ 7-segmented, relatively long, exceeding one-half the length of body, brownish black throughout; flagellar segments gradually decreasing in length outwardly, the first exceeding in length the succeeding two combined; terminal segment a small oval button; flagellar segments with a short dense erect pubescence and slightly longer, more decumbent verticils. Head polished dark brown; anterior vertex wide.

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* Alexander, C. P., "Crane-flies of the Baltic Amber (Diptera)." Bernstein-Forschungen, ii. pp. 58–59, figs. 68, 69, 70 (1931).

† Alexander, C. P., "New or little-known Tipulidæ from Eastern Asia (Diptera).—II." Philippine Journ. Sci. xxxv. pp. 466–468, pl. i. fig. 5, 5 *a* (1928).

Mesonotum polished black; præscutal setæ very sparse to almost lacking. Pleura, including pleurotergite, obscure yellow. Halteres dark brown. Legs with the coxæ and trochanters obscure yellow; femora obscure yellow passing into brown; tibiæ yellowish brown; tarsi black. Wings (fig. 6) with a brownish tinge, unpatterned; stigma lacking; veins brown. Abundant macrotrichia on all longitudinal veins beyond cord, on the entire length of *Rs*, distal half of *M* and distal end of *Cu*. Venation: *Sc* long, Sc_1 ending shortly before fork of the long *Rs*; R_{3+4} present, longer than R_{1+2} and two-thirds R_{2+3+4}, cell R_3 thus relatively short; cell 1*st* M_2 open by atrophy of basal section of M_3; *m–cu* shortly beyond the fork of *M*.

Abdominal tergites black; sternites dull black, the caudal margins of the segments somewhat paler; hypopygium black.

Hab. Ecuador (Oriente).

Holotype, ♂, Abitagua, altitude 1200 metres, April 5, 1937 (*Macintyre*).

Hexatoma (*Eriocera*) *patens* is very different from all of the numerous Neotropical members of the subgenus so far discovered. The open cell 1*st* M_2 is found elsewhere only in the Australian *H.* (*E.*) *aperta* (Alexander).

ELEPHANTOMYIA Osten-Sacken.

1859. *Elephantomyia* Osten-Sacken, Proc. Acad. Nat. Sci. Philadelphia for 1859, p. 220.

ELEPHANTOMYINA, subgen. nov.

Characters as in *Elephantomyia*, s. s., differing especially in the venation (fig. 7). A strong supernumerary crossvein in cell R_3, connecting with vein R_3 shortly before tip of latter; *r–m* connecting with *Rs* a short distance before its fork. Tibial spurs lacking.

Type of subgenus, *Elephantomyia* (*Elephantomyina*) *supernumeraria* Alexander (Neotropical).

Elephantomyia (*Elephantomyina*) *supernumeraria* Alexander.

1921. *Elephantomyia supernumeraria* Alexander, Proc. Acad. Nat. Sci. Philadelphia for 1921, pp. 60–61.

Hitherto known only from the type-males, from the Napo River, Peru, collected June 8, 1920, by Parish.

Female.—Length, excluding rostrum, about 8·5 mm.; wing 8 mm.; rostrum about 6 mm.

Characters as in male, differing as follows:—Size much larger. Wings with *m–cu* about its own length beyond fork of *M* or at near one-third the length of cell. Abdominal sternites three to seven, inclusive, each with a large whitish yellow median spot on distal half. Valves of ovipositor slender.

Allotype, ♀, Abitagua, Orionte, Ecuador, altitude 1200 metres, April 7, 1937 (*Macintyre*).

Elephantomyia (*Elephantomyia*) *subhumilis*, sp. n.

Rostrum nearly as long as body; head light grey; mesonotum almost uniformly brownish yellow; femora and tibiæ brown, the tarsi paling to yellow; stigma distinct; *Rs* long, about one-half longer than cell 1*st* M_2; abdomen obscure yellow, in male darkened subterminally male hypopygium without a dense setiferous cushion on mesal face of basistyle; inner dististyle nearly straight.

Male.—Length, excluding rostrum, about 5·5 mm.; wing 5·8 mm.; rostrum about 5 mm.

Female.—Length, excluding rostrum, about 7 mm.; wing 7 mm.; rostrum about 6 mm.

Rostrum nearly as long as body, brownish black throughout. Antennæ dark brown, the verticils very long. Head with the front and anterior vertex light grey, the posterior vertex a little darker; anterior vertex narrow, about equal in width to the diameter of scape; eyes large.

Mesonotum almost uniform brownish yellow, unmarked; setæ of præscutal interspaces relatively small and inconspicuous. Pleura brownish yellow to pale brown. Halteres pale. Legs with the coxæ and trochanters yellow, fore coxæ a trifle darker; femora and tibiæ brown, the outer tarsal segments paling to yellow; legs with scattered bristles, more erect and conspicuous on the tibiæ. Wings subhyaline, the prearcular and basal portions, including the costal border, light yellow, the outer fields more greyish; stigma oval, brown; veins brown, yellow in the basal and costal regions. Venation: Sc_2 ending about opposite four-fifths the length of the long *Rs*, Sc_1 nearly atrophied; branches of *Rs* generally parallel to one another for most of their length, a little diverging at outer ends; cell *1st* M_2 relatively short and broad, the greatest width about two-thirds the length; *m–cu* at near one-third the length of cell *1st* M_2, longer than the second section of Cu_1; cell *2nd A* moderately wide.

Abdomen obscure yellow, darker laterally; segment seven in male darkened; hypopygium yellow. In female the tergites slightly more darkened on posterior portions. Male hypopygium with the mesal face of basistyle without a dense cushion of setæ, as in *humilis*. Outer dististyle longer and more slender, the base narrow, surface glabrous. Inner dististyle nearly straight, not conspicuously narrowed on distal portion, the surface with long coarse setæ.

Hab. Ecuador (Oriente).

Holotype, ♂, Abitagua, altitude 1200 metres, April 7, 1937 (*Macintyre*). *Allotype*, ♀.

Elephantomyia (*Elephantomyia*) *subhumilis* is most similar to *E.* (*E.*) *humilis* Alexander (Colombia), differing especially in the details of venation and in the structure of the male hypopygium.

Elephantomyia (*Elephantomyia*) *setulistyla*, sp. n.

General coloration of præscutum obscure yellow, with a broad, dark brown, median stripe; rostrum a trifle shorter than body; femora and tibiæ dark brown, the tarsi paling to yellow; wings subhyaline, the outer cells weakly darkened; stigma brown; *m–cu* close to mid-length of cell *1st* M_2; abdomen dark brown, the hypopygium a little brightened; outer dististyle terminating in two slender spines, the surface with conspicuous erect setulæ.

Male.—Length, excluding rostrum, about 4·5 mm.; wing 5 mm.; rostrum 4 mm.

Rostrum a trifle shorter than body, brownish black throughout. Antennæ black throughout; outer flagellar segments elongate, with very long verticils. Head dark.

Mesonotal præscutum obscure yellow, with a broad, dark brown, median stripe; scutellum darkened medially and on mesial portions of lobes, paler laterally; scutellum and postnotum dark brown. Pleura dark brown, the posterior sclerites a little paler. Halteres with stem yellow, knob infuscated. Legs with coxæ dark; trochanters obscure yellow; femora and tibiæ dark brown;

tarsi paling to yellow; tibial spurs not evident. Wings subhyaline, the outer cells weakly more darkened; prearcular region brightened; stigma long-oval, brown; veins brown, paler in the basal areas. Venation: Sc_1 ending about opposite two-thirds the length of the relatively short *Rs*; branches of *Rs* generally parallel to one another for most of their length; cell *1st* M_2 about equal in length to the longest vein beyond it; *m–cu* close to mid-length of cell, longer than distal section of vein Cu_1; cell *2nd A* moderately wide.

Abdomen dark brown; hypopygium a little brightened. Male hypopygium with the outer dististyle relatively large, flattened, terminating in a long, slightly decurved spine, with a slightly smaller spine on outer margin at near three-fourths the length of style; surface of style with abundant erect setulæ. Inner dististyle broad at base, strongly narrowed on apical third.

Hab. Ecuador (Oriente).

Holotype, ♂, Abitagua, altitude 1200 metres, April 7, 1937 (*Macintyre*).

Elephantomyia (*Elephantomyia*) *setulistyla* is most generally similar to *E.* (*E.*) *humilis* Alexander (Colombia), differing in the patterned thorax and in the structure of the male dististyles, as the setulose outer style.

Elephantomyia (*Elephantomyia*) *brunneipennis*, sp. n.

Size small (wing 5 mm.); mesonotum uniformly dark brown, unpatterned; legs black, the tarsi paling to dark brown; wings with a strong brown tinge, the stigma barely differentiated; branches of *Rs* parallel to one another for their entire length; *m–cu* beyond mid-length of cell *1st* M_2; abdominal tergites black, sternites yellow.

Sex ?—Wing 5 mm.

Head broken.

Mesonotum uniformly dark brown unpatterned. Pleura chiefly dark. Halteres with stem dusky, knob infuscated. Legs with coxæ and trochanters brownish yellow; remainder of legs brownish black, the tarsi paling to dark brown; femora and tibiæ with several conspicuous erect subspinous bristles, additional to the normal more delicate appressed setæ. Wings with a strong brown suffusion, the stigma barely differentiated against the ground; veins brown. Venation: *Sc* long, Sc_1 ending about opposite four-fifths the length of *Rs*, Sc_2 at tip of Sc_1; *Rs* weakly angulated at origin; branches of *Rs* parallel to one another for their entire length; cell *1st* M_2 about equal in length to vein M_3 beyond it; *m-cu* at near three-fifths the length of the lower face of cell *1st* M_2; cell *2nd A* relatively narrow.

Abdominal tergites black, sternites yellow; outer portion of abdomen broken.

Hab. Ecuador (Oriente).

Holotype, sex ?, Abitagua, altitude 1200 metres, April 19, 1937 (*Macintyre*).

Elephantomyia (*Elephantomyia*) *brunneipennis* is most closely related to *E.* (*E.*) *humilis* Alexander, differing in the dark colour of the body, the almost uniformly black legs, and the strongly infumed wings, with the stigma scarcely indicated.

TRENTEPOHLIA Bigot.

1854. *Trentepohlia* Bigot, Ann. Soc. Ent. France, (3) ii. p. 473.

PROMONGOMA, subgen. nov.

Characters as in the subgenus *Mongoma* Westwood, differing in details of venation. Vein R_3 entirely atrophied, as in *Anchimongoma* and *Plesiomongoma*; vein R_5 fused with M_{1+2} for some distance beyond the outer end of cell *1st* M_2, this distance subequal to vein *m*, giving the superficial appearance of a vein and cell M_1 (fig. 8); cell *Cu* at margin widely open, the distance between Cu_1 and *1st A* greater than the length of the distal section of Cu_1.

Type of subgenus, *Trentepohlia* (*Promongoma*) *mirabilis*, sp. n. (Neotropical).

The remarkable fly that is made the type of the new subgenus *Promongoma* is one of the most striking Tipulidæ known to me. The first impression given by the venation of the insect is that there is but a single branch of *Rs* remaining, as in *Toxorhina* Loew, and that the medial field is four-branched, much as in *Limnophila* Macquart (fig. 8). The true explanation of the venation is given under the subgeneric diagnosis, and has been produced by the entire atrophy of vein R_3 and the unusual fusion of veins R_5 and M_{1+2}.

The seven subgenera of *Trentepohlia* so far defined may be separated as follows :—

1.	Vein R_3 entirely atrophied	2.
	Vein R_3 present	4.
2.	Only two outer medial veins, M_{1+2} and M_4, present. (Oriental.)	*Anchimongoma* Brunetti.
	Three branches of M, M_{1+2}, M_3, and M_4 present	3.
3.	Veins R_5 and M_{1+2} fused to opposite the level of outer end of cell *1st* M_2 ; cell *Cu* closed by apical fusion of veins Cu_1 and 1*st* *A*. (Oriental, Australasian.)	*Plesiomongoma* Brunetti.
	Veins R_5 and M_{1+2} fused for some distance beyond the level of the outer end of cell *1st* M_2, forming a petiole to cell R_5 ; cell *Cu* widely open at margin. (Neotropical.)	*Promongoma*, subgen. nov.
4.	Vein and cell M_3 present ; four veins, R_5, M_{1+2}, M_3, and M_4, issuing from cell *1st* M_2.	5.
	Vein and cell M_3 lacking ; three veins, R_5 and two branches of M, issuing from cell 1*st* M_2	6.
5.	Cell *Cu* widely open at wing-margin, the distance greater than the length of the distal section of Cu_1. (Neotropical.)	*Neomongoma* Alexander.
	Cell *Cu* closed at wing-margin, very narrowly open only in the Oriental *flava* Brunetti, the distance less than one-half the distal section of Cu_1. (Palæotropical.)	*Mongoma* Westwood.
6.	Cell M_2 open by the atrophy of *m* and both sections of vein M_3 ; cell *Cu* closed by apical fusion of veins Cu_1 and 1*st* *A*. (Palæotropical.)	*Trentepohlia* Bigot.
	Cell 1*st* M_2 closed ; cell *Cu* open at wing-margin. (Tropicopolitan, chiefly Neotropical.)	*Paramongoma* Brunetti.

Trentepohlia (*Promongoma*) *mirabilis*, sp. n.

General coloration obscure brownish yellow ; femora testaceous yellow, the tips narrowly white, preceded by a brown subterminal ring ; tibiæ and tarsi white, in male the tibiæ extensively darkened on central portion ; wings yellow, the stigma dark brown, conspicuous.

Male.—Length about 10 mm. ; wing 9 mm.

Female.—Length about 11–12 mm. ; wing 9–9·5 mm.

Rostrum and palpi dark brown. Antennæ with scape and pedicel obscure yellow, flagellum black ; flagellar segments oval, with verticils of moderate length. Front and the very reduced anterior vertex silvery, the posterior vertex infuscated, the genæ grey; a weak median carina on posterior vertex.

Entire thorax obscure brownish yellow, without distinct markings; dorsal pleural region a trifle darker. Halteres infuscated, the base of stem restrictedly paler. Legs with the coxæ and trochanters obscure yellow; remainder of legs long and slender; femora testaceous yellow, near outer end deepening to form a brown subterminal ring, the tip abruptly white; tibiæ and tarsi white in female, in the male the tibiæ more infuscated, with the narrow bases and slightly wider tips white. Wings (fig. 8) with a yellow tinge, the costal portion somewhat more intensely so; stigma small, oval, dark brown; veins yellow. Venation as described under the subgenus; position of *m–cu* slightly variable, from just before to just beyond the fork of *M*. In the type-male the fusion of veins R_5 and M_{1+2} beyond cell *1st* M_2 is slightly less than in the females.

Abdominal tergites dark brown, the caudal borders of the segments narrowly paler brown; sternites more yellowish, especially in male. Ovipositor with the cerci elongate, gently upcurved, dark brown.

Hab. Ecuador (Oriente).

Holotype, ♂, Abitagua, altitude 1200 metres, August 15, 1937 (*Macintyre*). *Allotopotype*, ♀, April 4, 1937. *Paratopotype*, ♀, April 3, 1937.

Trentepohlia (*Promongoma*) *mirabilis* is so distinct from all other known members of the genus that any comparison is unnecessary. The most similar species in the Neotropics is *T.* (*Neomongoma*) *disjuncta* (Alexander).

Teucholabis (*Teucholabis*) *sultana*, sp. n.

Mesonotal præscutum yellow, varied with black; head black; halteres dark throughout; femora yellow, the tips broadly blackened; wings brown, variegated before and beyond cord with cream-yellow areas; Sc_1 ending about opposite two-thirds the length of *Rs*; branches of *Rs* parallel to one another for almost their entire length; abdomen black; male hypopygium with the basistyle produced at apex into a needle-like spine; outer dististyle profoundly bifid; ædeagus terminating in a slender black spine.

Male.—Length about 6 mm.; wing 6 mm.

Female.—Length about 5·5 mm.; wing 5 mm.

Rostrum and palpi black, the former about equal in length to remainder of head. Antennæ black throughout; flagellar segments oval. Head black.

Pronotum yellow. Mesonotal præscutum yellow, in male with three relatively small isolated black spots, representing the anterior ends of the median and lateral stripes; in female the black colour much more extensive, consisting of three confluent black stripes, restricting the ground to the humeral region; scutum yellow in male, the cephalic-lateral angles restrictedly blackened, in female the lobes chiefly black; scutellum and mediotergite obscure yellow. Pleura yellow, unmarked in male, in female with a transverse black girdle that occupies the entire mesepisternum. Halteres infuscated. Legs with the fore and middle coxæ and trochanters yellow; posterior coxæ and trochanters black; femora yellow, the tips broadly blackened, more extensively so on fore legs and to a greater degree in female than in male; tibiæ brownish yellow, restrictedly darkened at both ends; tarsi black. Wings variegated brown and cream-yellow, the dark colour including the prearcular region, cells *C* and *Sc*, a band at cord, and the entire wing-tip beyond level of outer end of cell *1st* M_2, the two latter areas interconnected at anterior and posterior wing-margins; a dark cloud at end of vein *2nd A* and another including the basal third of cell *Cu*; a weak cloud at origin of *Rs*; veins brown, pale yellow in the cream-coloured areas. Venation: *Sc* relatively long, Sc_1 ending about opposite two-thirds *Rs*; R_2 from one-half to about its own length beyond fork of *Rs*, transverse to oblique; branches of R_3 parallel to one another for almost their entire length, cell R_3 at margin thus very extensive; cell *1st* M_2 subequal to longest vein beyond it, longer in female; *m–cu* shortly beyond fork of *M*.

Abdomen, including hypopygium, black. Male hypopygium with the basistyle produced at apex into a needle-like spine; face of basistyle with a narrow blackened flange. Outer dististyle profoundly bifid, both arms long, simple, the inner arm shorter, terminating in a short spine with numerous setæ around its base; outer arm a little longer, with long coarse setæ, the apex short-spinous.

Inner dististyle complex, bearing a slender lateral arm on outer margin at base; apex of main arm of style bidentate by a shallow notch. Ædeagus relatively broad, terminating in a slender black spine.

Hab. Ecuador (Oriente).

Holotype, ♂, Abitagua, altitude 1200 metres, April 19, 1937 (*Macintyre*). *Allotopotype*, ♀.

Teucholabis (*Teucholabis*) *sultana* is closest to *T.* (*T.*) *læta* Alexander (Peru), differing in details of coloration of the head, thorax, legs, and abdomen.

Teucholabis (*Teucholabis*) *longispina*, sp. n.

Allied to *trifasciata*; general coloration black, the pronotum obscure brownish yellow; knobs of halteres yellow; posterior femora entirely black; wings whitish subhyaline, trifasciate with brown, the outer band apical; abdomen, including hypopygium, black; basistyle with apical spine small; outer dististyle elongate, at near mid-length dilated and strongly setiferous, the apex produced into a long glabrous spine; ædeagus at apex produced into two triangular flange-like points.

Male.—Length about 5·5 mm.; wing 5·3 mm.

Rostrum about equal to remainder of head, black; palpi black. Antennæ black throughout; basal flagellar segments oval, the outer segments short and crowded. Head black.

Pronotum and pretergites obscure brownish yellow. Mesonotum uniformly polished black, the præscutum with sparse erect setæ. Pleura black, the dorsal sternopleurite and meral region with a sparse grey pruinosity. Halteres with stem black, knob pale yellow. Legs with the coxæ and trochanters black; fore and middle femora with about the basal half brownish yellow, the distal half black; posterior femora entirely black; tibiæ brownish black, the tips blackened; tarsi black. Wings whitish subhyaline, heavily patterned with brown, as follows:—Cell *Sc*; a narrow band at level of origin of *Rs* and fork of *Sc*, in cell *Cu* extended somewhat more basad; a narrow band at cord, deepest in stigmal region, paler at posterior end of band; wing-tip broadly darkened, the colour extending back as far as level of outer end of cell *1st* M_2, the extreme base of cell M_3 pale; veins brown, scarcely darker in the clouded portions. Venation:

Sc relatively short, Sc_1 ending about opposite one-third the length of *Rs*, Sc_2 some distance from tip; *Rs* nearly straight on basal half, thence arcuated; *m–cu* about twice R_{2+3+4}; branches of *Rs* generally parallel to one another or with anterior branch a little arcuated on basal half, slightly widening cell R_3 at that point; cell 1*st* M_2 relatively long; *m–cu* about one-half its length beyond fork of *M*.

Abdomen, including hypopygium, black. Male hypopygium with spine of basistyle subterminal, relatively small, broad-based, narrowed rapidly into a slender spine; flange on face of basistyle blackened, the margin with about six or seven irregular denticles. Outer dististyle elongate, narrowed at base, swollen at near mid-length, the distal third directly prolonged into a long, slender, nearly straight, glabrous spine; dilated central portion with abundant long coarse setæ, at near its base with a single curved spine. Inner dististyle simple, the beak bidentate. Ædeagus at apex produced into two small triangular flange-like points.

Hab. Ecuador (Oriente)

Holotype, ♂, Abitagua, altitude 1200 metres, April 4, 1937 (*Macintyre*).

In its general appearance the present species is very similar to *Teucholabis* (*Teucholabis*) *trifasciata* Enderlein, differing especially in the coloration of the legs and structure of the male hypopygium, notably of the spine of the basistyle, the outer dististyle, and the ædeagus.

Teucholabis (*Teucholabis*) *nigropostica*, sp. n.

Allied to *trifasciata*; general coloration of head, thorax, and abdomen polished black; pronotum above obscure yellow; knobs of halteres pale yellow; legs black, the bases of the fore and middle femora yellow, the posterior femora uniformly black; wings whitish subhyaline, with three dark brown bands, the basal one narrow, parallel-sided; Sc_1 ending about opposite one-fourth the length of *Rs*; R_2 at fork of *Rs*; *m–cu* at fork of *M*; male hypopygium with the spine of basistyle short, spike-like; outer dististyle simple, apex not spinous; ædeagus at apex produced laterad into a long blackened spine.

Male.— Length about 5·5 mm.; wing 4·5 mm.

Female.—Length about 5 mm.; wing 4·5 mm.

Rostrum black, a little longer than the remainder of head; palpi black. Antennæ black throughout. Head entirely polished black.

Pronotum obscure yellow above, infuscated on sides; anterior lateral pretergites light yellow. Mesonotum uniformly polished black, the præscutum almost without setæ. Pleura black, with a narrow pruinose longitudinal stripe beginning behind the fore coxæ, passing beneath the halteres. Halteres blackened, the knobs pale yellow. Legs with the coxæ and trochanters black; fore and middle femora yellow basally, the tips broadly blackened, on fore legs including nearly the distal two-thirds; posterior femora entirely black; tibiæ and tarsi black. Wings whitish subhyaline, with three dark brown bands; first band at level of origin of *Rs*, narrow, parallel-sided; second band at cord, slightly wider, narrowest at near mid-length, slightly paler at posterior portion in cells *Cu* and *1st A*; outer band apical, relatively narrow, leaving the basal third to fourth of cells *2nd* M_2 and M_3 pale; cell *Sc* dark throughout; outer end of cell *1st* M_2 narrowly seamed with brown; veins dark brown. Venation: Sc_1 ending about opposite one-fourth the length of the long R_2; R_2 at fork of *Rs*, in alignment with the remainder of the anterior cord; branches of *Rs* nearly parallel to one another, a little divergent at near mid-length; R_5 strongly divergent on distal fourth; cell *1st* M_2 long, subequal to vein M_3 beyond it; *m–cu* at fork of *M*.

Abdomen, including hypopygium, black. Male hypopygium with the spine of basistyle short and spike-like. Outer dististyle of moderate length, consisting of a simple, gently curved structure, the entire surface with unusually long coarse setæ; apex not spinous. Inner dististyle with beak bidentate, the teeth separated by a very shallow notch; a quadrate basal lobe, the apex subtruncate. Ædeagus at apex produced laterad into a long blackened spine.

Hab. Ecuador (Oriente).

Holotype, ♂, Abitagua, altitude 1200 metres, April 5, 1937 (*Macintyre*).

By existing keys the present fly runs to *Teucholabis* (*Teucholabis*) *trifasciata* Enderlein, differing in the coloration of the legs, the different wing-pattern, and especially in the structure of the male hypopygium.

Teucholabis (*Teucholabis*) *scabrosa*, sp. n.

General coloration of mesonotum brown, without conspicuous markings; femora yellow, the tips very narrowly dark brown; wings broad, subhyaline, stigma dark brown; Sc_1 ending about opposite mid-length of *Rs*; male hypopygium with the apical blade of basistyle bispinous at tip; outer dististyle with the surface unusually roughened by coarse setæ and abundant scabrous points.

Male.—Length about 5·5 mm.; wing 5·5 mm.

Rostrum and palpi black. Antennæ black throughout; flagellar segments oval, the verticils much longer than the segments. Head dull brownish grey, restrictedly brightened behind.

Pronotum and pretergites pale yellow. Mesonotal præscutum brown, without markings, the humeral and lateral portions restrictedly yellow, the interspaces with scattered erect setæ; posterior sclerites of notum brown, the scutum behind the suture even darker. Pleura yellow, with a more or less distinct brown longitudinal stripe, extending from the fore coxæ to the postnotum, passing above root of halteres. Halteres with stem pale, knob dusky. Legs with the fore coxæ and trochanters darkened, the others yellow; femora yellow, the tips very narrowly but distinctly dark brown; tibiæ yellow, the tips even more restrictedly darkened; basitarsi pale; remainder of tarsi dark brown; claws toothed. Wings broad, subhyaline, the base slightly more yellow; stigma circular, dark brown; veins pale brown, more yellowish in the basal portions. Venation: Sc_1 ending nearly opposite mid-length of the long *Rs*, Sc_2 some distance from tip; R_2 subequal to R_{2+3+4}, both longer than R_{1+2}; branches of *Rs* generally parallel to one another for almost the entire length of anterior branch, the posterior one, R_5, thence bent very strongly caudad, ending at wing-tip and greatly widening cell R_3; cell 1*st* M_2 relatively narrow, subequal in length to vein M_4 beyond it; *m–cu* shortly beyond fork of *M*.

Abdomen dark brown, the caudal margins of the segments paler; hypopygium brightened. Male hypopygium with the apical blade of basistyle short and stout, flattened, at apex bispinous, the longer apical spine directed strongly laterad, outer end of blade with several erect setæ; lateral flange of basistyle conspicuously blackened, the margin entire or merely crenulate, not serrate. Outer dististyle a straight rod, the entire surface with long conspicuous setæ, interspersed with abundant scabrous points, producing an unusually roughened appearance. Inner dististyle complex, terminating in three blackened points, two of which are acute blackened spinous points, the outer beak-like portion a flattened blade terminating in several teeth of various sizes. Ædeagus pale, the apex produced into a flattened trough-like point, not markedly produced; ventral surface of ædeagus before the apex with an extensive group of long setæ from conspicuous punctures.

Hab. Ecuador (Oriente).

Holotype, ♂, Abitagua, altitude 1200 metres, April 2, 1937 (*Macintyre*).

Teucholabis (*Teucholabis*) *scabrosa* is very distinct from all other described species. It is apparently most nearly related to species such as *T.* (*T.*) *inulta* Alexander (Brazil), yet differs in all details of structure of the male hypopygium.

Toxorhina (*Toxorhina*) *curvata*, sp. n.

General coloration brown, the lateral borders of præscutum conspicuously pale grey; pleura testaceous yellow, with a longitudinal brown stripe; wings ochreous, the veins a little darker than the ground; abdomen bicoloured, the incisures dark, the central portion of the individual segments yellow; male hypopygium with the apical spine of basistyle strongly curved; posterior portion of dististyle produced into a long pale tail-like extension.

Male.—Length, excluding rostrum, about 6·5 mm.; wing 5·5 mm.

Female.—Length, excluding rostrum, about 8 mm.; wing 6 mm.; rostrum about 6·5 mm.

Rostrum black, in female exceeding the wing in length, in type-male partly concealed beneath body and length uncertain, but apparently proportionately shorter than in female. Antennæ dark brown, the large pedicel a little brighter, obscure orange. Head buffy grey.

Pronotum dark brown. Mesonotal præscutum brown, the lateral borders pale grey, the disk without clearly delimited stripes; posterior sclerites of notum brown, very sparsely pruinose. Pleura testaceous yellow, with a longitudinal brown stripe across the dorsal sclerites. Halteres dusky. Legs with the coxæ and trochanters yellow; remainder of legs brown, the tibial tips not darkened. Wings ochreous, the veins a little darker than the ground A few trichia on *Rs* but none on its branch. Venation. *m–cu* close to fork of *M*.

Abdomen bicolorous, the incisures dark, including both base and apex of segments, the central portion of the segments yellow; hypopygium pale. Male hypopygium with the basistyle terminating in a slender spine, the distal third curved, much like a shepherd's crook. Dististyle consisting of a subquadrate blackened structure, the surface densely spinulose, the outer angle produced into a long pale appendage that is nearly twice as long as the body of style. Arms of ædeagus relatively short.

Hab. Ecuador (Oriente).

Holotype, ♂, Abitagua, altitude 1200 metres, April 20, 1937 (*Macintyre*). *Allotopotype*, ♀.

Toxorhina (*Toxorhina*) *curvata* is quite different from other described species in the structure of the male hypopygium. The identity of *T*. (*T*.) *longicollis* Pierre (Venezuela) is very problematical. The figures of the describer (Encycl. Ent., Diptera, i. pp. 80–81, figs. 6–121 (1924)) are either highly inaccurate or else represent a type of venation and male hypopygium quite unknown in the genus.

XLIII.—*Descriptions and Records of Bees*.—CLXVIII.

By T. D. A. Cockerell, University of Colorado.

Lithurgus capensis Friese.

Typical males from Bot River, C.P., and Gobabis, Okahoa Farm (S.W. Africa), taken by the Ogilvies. A small male from Blankrans, near Calvinia (*L. Ogilvie*).

Anthophora livingstonei, sp. n.

♀.—Length about 11 mm.

Black, the hair of head and thorax above clear light orange-ferruginous, with dark hairs intermixed on scutellum and disk of mesothorax, but none on head; cheeks, except upper end, and lower part of thorax with white hair; eyes pale reddish; facial quadrangle longer than broad; clypeus short, keeled, entirely pale dull yellow except a short black band at each side above; supraclypeal mark a transverse band, not angulate above; no lateral marks; labrum yellowish white, with a pair of large pale brown spots; mandibles broadly yellowish white at base; basal half of scape red; flagellum very short (about 2 mm.), obscurely reddish beneath; fourth antennal joint very short, tegulæ light rufo-testaceous. Wings brownish hyaline. Legs dark reddish, femora with white hair, tibiæ and tarsi with black, the hair of hind tibiæ and tarsi all black except a little pale along hind edge of tibia. Abdomen with successively paler fulvescent bands on first three tergites, the second and third white at sides, and band on fourth tergite clear white; on second and third tergites the hair before the band is black, on fourth it appears grey from a mixture of black and white; apex with black hair, white at sides.

Tanganyika Territory: Ujiji, August 1931 (*Cockerell*).

It was found near the spot (now marked by a monument) where Stanley met Livingstone. It has the aspect of *A. torrida* Smith, but is easily known by the yellow clypeus and black hair of hind tibiæ. In my key in Rev. Zool. Bot. Afr. xxviii. p. 207, it runs out at 2 on account of the partly red scape, but the clypeus separates it from all the species cited.

Anthophora torrida Smith.

Belgian Congo: Luputa (*J. Bequaert*).

Two females, one of them peculiar, with four broad red hair-bands on abdomen. I hesitated whether to regard this form as a distinct species, and I now think it is very probably the hitherto unknown female of *A. vanderysti* Ckll., which in the male has similar red bands.

Anthophora kigomensis, sp. n.

♂.—Length about 11 mm.

Black, the head and thorax above with clear orange-fulvous hair, very pale on the head, the thorax without black hairs; eyes light red; scape yellow in front; flagellum rather long, all dark, except a red spot near base; face shining, clypeus prominent, with a large triangular flattened area; supraclypeal mark a narrow band, not angulate above; clypeus pale yellow, with a diamond-shaped black mark on each side above, not reaching halfway down sides; lateral marks filling space between clypeus and eye, terminating on inner side above a little above the middle of the black marks, but on outer side with a linear prolongation up orbits; labrum very pale yellowish, rugoso-punctate, with a pair of dark brown spots; mandibles with a very large oval pale yellow basal spot, and beyond this a red area; mesopleura with yellowish hair; tegulæ pale ferruginous; wings brownish hyaline; front legs with long white hair; middle and hind legs with black hair; middle tarsi with a broad fan-shaped black brush at end; first tergite with long pale fulvous hair and a very narrow but entire apical band; second tergite with a similar band, the tegument of the margin reddish; third to sixth with successively broader and paler bands, on the last three they may be called white.

Tanganyika Territory: Kigoma, Aug. 31, 1931 (*J. Ogilvie*).

A species of the *A. vestita* group, and hence not related to the superficially similar *A. nigritarsis* Friese and *A. diloloensis* Ckll. It is allied to *A. elimata* Ckll. from S. Rhodesia, but that is larger, with white hair on middle and hind legs, and the clypeal marks have the lower edge strongly excavated or concave. I had to consider whether this could be the male of *A. livingstonei*, but the latter has the clypeus dull, with much less black, and broad hair-bands on the first two tergites. In the black hair of middle and hind legs this resembles *A. postica* Vachal.

Anthophora rufolanata Dours.

This has been known only in the female, but males which I place here come from Kirstenbosch and Bot River, C.P., collected by the Ogilvies. They are remarkable for the variation in the colour of the abundant long hair, from strongly red to whitish, always with much black on thorax above. The supraclypeal mark is a transverse band, not angulate above, but the middle tarsi do not have a black fan-shaped brush. The head is quite broad; scape with a light yellow stripe in front; clypeus yellow, with a short black band on each side above; labrum yellow, with the usual dark spots, and much white hair; mandibles with a large yellow spot; lateral marks filling lower part of space between clypeus and eye. Compared with *A. vestita* Smith there is not much difference, except that the abdomen does not appear red, but is dark, with pale bands. Females of *A. rufolanata* were taken at Kirstenbosch and Bot River. In the female the clypeus varies to all black except a very small yellow spot near the margin on each side.

According to the original description of Dours (1869) *A. rufolanata* came from Caffraria, and has the first four abdominal tergites with red and black hair mixed (a character which excludes *A. vestita*), and the hind margins with bands of red hair. The specimens from western S. Africa differ in that, although the thoracic hair varies from red to whitish, that of the abdomen is not red. It may well be that a distinct subspecies is indicated. I have, however, a specimen with red hair-bands on abdomen, which does not agree well with the description of *A. rufolanata* in other respects. I describe it below as a distinct species, related to *A. rufolanata* and *A. vestita*.

Anthophora honorata, sp. n.

♀.—Length about 11·5 mm.

Robust, black, the face black except that the clypeus has a transverse yellow mark at each side near margin, hard to see on account of the dense covering of hair; base of mandibles with an elongate yellow spot; hair of face long and abundant, dull white (ashy reddish in *rufolanata*); vertex with black hair; antennæ entirely black; thorax above with cinereous hair mixed with black, but light red about base of wings and white on mesopleura; tegulæ pale red; wings conspicuously brownish (clear in *rufolanata*); hind tibiæ externally with white hair, and a dark brown stripe from knee; hind basitarsi with long white hair on outer side, light red on inner; first three tergites with red hair, fourth and apex with black, tergites 2 to 4 with red hair-bands, the colour bright, sides of abdomen with white hair. Seen from above, the abdomen appears black with red bands.

Cape Province: Beaufort West (*J. Ogilvie*).

This is one of the ambiguously labelled specimens, with the impossible date June 30. If we read April 30, this agrees with the time at Beaufort West. Superficially the insect looks like *A. rubricans* Ckll. Beaufort West is a dry region, rainfall 8·46 inches.

Anthophora pallidicincta Cameron.

Cape Province: Beaufort West (*J. Ogilvie*).

The label is ambiguous, but if the date, June 30, is changed to read April 30, the specimen should come from Beaufort West. The specimen is a male, agreeing with Cameron's description; a specially noteworthy feature is the large pale red area on under side of abdomen, occupying the middle (but not sides) of third and fourth sternites. The clypeal marks are like a shoe with a very long slender toe, and a narrow black line, directed downward, for the heel. There is copious black hair on the vertex, and the thorax above has dull white hair, with some black intermixed. The supraclypeal mark is a transverse band, not angulate above.

A. greyæ Ckll. also has a light red patch on under side of abdomen, and is in all respects a very similar species, but the clypeus is much larger and higher. *A. greyæ* was supposed to be distinguished from *A. pallidicincta* by the broad black brush on middle tarsi, but I find a black brush (not so broad) in *A. pallidicincta*. It may be open to question whether Cameron's species is really the one I have so identified, or *A. greyæ*. The two species are apparently distinct. Brauns saw the female attributed by Cameron to his species, and it was *A. vestita*, but this has no bearing on the use of the name. The type-locality of *A. pallidicincta* is Stellenbosch, which is about 180 miles from Beaufort West, and has a much moister climate.

Anthophora griseovestita Ckll., based on the male, has a larger (longer) clypeus than *A. pallidicincta* from Beaufort West, but I think it is the same species. It came from Rosebank, about 22 miles from Stellenbosch.

Anthophora argyrospila, sp. n.

♂.—Length about 11·5 mm., anterior wing 8·5.

Black, with light yellow face-marks; eyes pale red; scape with a broad pale yellow stripe in front; flagellum black; supraclypeal mark a transverse band, not angulate above; face shining; upper part of clypeus with two very large triangular black marks, separated by a rather narrow band, the inner apical corners produced; lateral marks filling most of space between clypeus and eye, but ending on inner side below middle of the adjacent black, thence very obliquely produced to a point on orbit, so that the whole lateral mark forms a very broad triangle with base on orbit, the basal corners very slender; labrum pale yellow, mandibles with a very large yellow spot; hair of head light ferruginous, without any dark, long and pure white on cheeks below; hair of thorax above, and upper half of sides, rich orange-ferruginous, with some conspicuous black hair on scutellum and a little on mesothorax; tegulæ clear ferruginous; wings brownish; legs with long pale hair, the mid-tarsi with a broad black brush at end; hair on inner side of basitarsi red; hind tibiæ with beautiful silvery-white hair, and a spot of dense white hair at end; hind basitarsi with a brush of very long white hairs at base; first tergite with long fulvous hair, giving way to black before the entire but narrow pale fulvescent band; tergites with black hair before the bands; hair-bands rather narrow, fulvous on second, dull white on the others; apex with white hair.

Belgian Congo (Katanga): Elisabethville (*J. Bequaert*).

A species of the *A. vestita* group, having the aspect of *A. torrida* Smith, but easily distinguished by the face-markings. It is actually nearer to *A. tetradonta* Ckll., which has quite a different appearance.

Anthophora langi Cockerell.

S.W. Africa: Otavi, one male (*J. Ogilvie*).

A variation with brown nervures and a very small light mark on scape.

Anthophora fallax Smith, var.

S.W. Africa: Windhoek, one male (*L. Ogilvie*).

This is *A. fallax* as now understood, but perhaps not the true species of that name. There is a large red spot at end of third antennal joint, whereby it approaches *A. diloloensis* Ckll. The hair of head and thorax is white, with a creamy tint in region of scutellum.

Anthophora grisella Cockerell.

Cape Province: Mafeking, one male (*J. Ogilvie*); Belmont, one male (*J. Ogilvie*).

Anthophora microleuca Cockerell.

Cape Province: Upington, Dec. 7 (*J. Ogilvie*).

One female, which appears to belong to *A. microleuca*, which was described from the male, taken at Swakopmund, nearly 600 miles distant. The female is robust, a little over 11 mm. long; head broad; scape black, with a small red mark; supraclypeal mark present but small, angulate above; clypeus with an extremely broad yellow band in middle, jointing a broad apical one, the large black marks with their inner lower corners rectangular; labrum yellow, with the spots small and pale brown; mandibles yellow on outer side except apically; no lateral face-marks; abdomen covered with white hair as in male; hair on inner side of hind basitarsi black.

Anthophora ogilviei Cockerell, var.

Orange Free State: North Bank Halt, Norvals Pont, April 16 (*J. Ogilvie*).

A variety with four broad pale yellowish bands on abdomen, and the white hair at sides of apex unusually short. It tends toward *A. rubricans* Ckll., but lacks the black hair at sides of thorax anteriorly, and is otherwise different. Male *A. ogilviei* was taken at the same place. *A. ogilviei* was also taken at Lobatsi and Mafeking.

Dianthidium pudicum (Cresson).

Colorado: Pagosa Junction, male, Sept. 3 (*B. Rotger*).

Xylocopa brasilianorum (Linnæus).

British Guiana: Waranama, Nov. 14 and 17, 2 ♀ (*J. Ogilvie*).

One is typical, but the other has the wings brilliant bluish green, only the lower margin purple. Schrottky records the same variation from Brazil, and it is the variety *virescens* (Lepeletier), described from Cayenne.

I find that the specimen of var. *virescens* from Waranama agrees in the colour of the wings with *X. darwini* Ckll. from Charles I., Galapagos, except that the latter shows none of the violaceous tint along the lower borders, so conspicuous in *virescens*. The specimen of *X. darwini* is smaller, with shorter wings, and does not have the strong elevated smooth band in middle of vertex which is present in the specimen of *virescens*. The first and second tergites are more finely punctured in the *X. darwini*. *X. nitens* Lep. was also taken at Waranama.

Andrena bipartita aswanica, subsp. n.

♀.—Like *A. bipartita* Brullé (*antilope* Pérez), except as follows:—Wings distinctly brownish, but not dark; second cubital cell somewhat contracted above; the hair, which is white in *A. bipartita*, is distinctly yellowish; first three tergites red.

Egypt: Aswan, Jan. 29, 1921, two (*Capt. K. J. Hayward*).

The following table separates a number of superficially similar female *Andrena*:—

	Area of metathorax strongly wrinkled (subg. *Trachandrena*)	1.
	Area of metathorax not wrinkled	2.
1.	Tergites 1–2 red; apical tergites bluish	*ægypticola* Friese.
	Tergites 1–3 red; third suffused with blackish; apical tergites not bluish	*balucha* Nurse.
2.	Hair of thorax above dull red; facial foveæ black; stigma rather broad, bright red, without a dark margin; second cubital cell small	*mitis* Schm.
	Hair of thorax above dull white or very faintly yellowish; facial foveæ not black; stigma narrow, with a more or less evident dark margin; second cubital cell large; hind tibiæ and tarsi red	3.
3.	Smaller, length about 10 mm.; clypeus partly red; tergites 1–3 red	*ilerda* Cameron.
	Larger, length 12–13 mm.; clypeus all black	4.
4.	Tergites 1–2 red	*bipartita* Brullé.
	Tergites 1–3 red (and other characters as above)	*bipartita aswanica*, [nom. nov.

Eucara penicillata (Friese).

Abyssinia: Higo Samula, Oct. 30, 1911, ♀ (*R. J. Stordy*); Kenya: Mombasa, 1906, ♂ (*A. J. Cholmley*); Uganda: Buamba Forest, Semliki Valley, 2300–2800 ft., Nov. 1911, ♂ (*S. A. Neave*). The hind knee-plate in the male is short, rounded, and shining black; in the female it is elongate and pale red. In both sexes the long hair at sides of metathorax is more or less sooty. The flagellum in the female from Mombasa is black.

E. macrognatha (Gerst.) was described from Mombasa, a female with the flagellum red beneath, as is conspicuously the case in the Uganda male recorded above. The type of *E. macrognatha* had been in alcohol, and the hair of the abdomen could not be described. Is it possible that it is not the species called *E. macrognatha* by Alfken and others, but actually *E. penicillata* ? Should this prove to be the case, the name *E. sheffieldi* (Meade-Waldo) will be available for the so-called *E. macrognatha*.

Allodape grandis Cockerell.

Cape Province : Hottentots, 40 miles from Cape Town, Nov. 6, 1930, ♀ (*H. W. Simmonds*).

When describing this species (1934) I omitted to note that the sixth tergite is trilobed, the middle lobe elongate and turned upward, the lateral ones very short and broad. The species is to be compared with *A. angulata* Brauns rather than with *A. friesei* Brauns.

The following key separates the species of this group :—

Smaller, length 5–7 mm. ; black, the face in female usually all black, but sometimes with a yellow line in middle of clypeus ; male with face black, or with a yellow stripe on clypeus. (Port Elizabeth and Willowmore.)	*paradoxa* Brauns.
Larger, 11 mm. long or over	1.
1. Abdomen red ; length about 11 mm., wings strongly reddened ; clypeus with no light marks, a very obscure reddish tint ; first recurrent nervure very far from base of second cubital cell (notes from type in British Museum)	*mucronata* Smith.
Abdomen black	2.
2. Length 13–16 mm. ; female clypeus normally with a median longitudinal yellow line ; male clypeus bright yellow, with a black lower margin ; female mesopleura with pale fulvous hair	*angulata* Brauns.
Length 11–12 mm. ; female clypeus all black ; male clypeus yellow, with a light reddish lower margin ; female mesopleura with dull white hair	*grandis* Ckll.

It seems very probable that *A. grandis* is to be considered a western race of *A angulata*, the type-locality of which must be held to be Uniondale, about 30 miles south-west of Willowmore (annual rainfall about 15 inches).

Allodape explanata Cockerell.

Cape Province : Worcester, Feb. 1929, 6 ♀, 6 ♂ (*Turner*).

The male, previously unknown, has a dark face like that of the female, with the light bands along the orbits extremely slender. I find that I had mixed with the series of *A. tristis* Ckll. a male from Huguenot (*J. Ogilvie*) which has the face dark, with pale lines along orbits, as in *A. explanata*, but the coarsely punctured clypeus associates it with *A. tristis*. This may perhaps be a male of *A. friesei* Brauns, although the size and general appearance agree better with *A. tristis*.

The female *A. friesei*, as shown by a Willowmore specimen received from Brauns, is about 11 mm. long, anterior wing 7·5 mm.

Allodape flavocincta ornatibasis, subsp. n.

♀.—Nearly agrees with *A. flavocincta* Ckll., from the Lower Congo, but about 9 mm. long; supraclypeal mark very small; wings strongly dusky, somewhat reddish ; front tibiæ black, with a small pale yellow stripe at base, and knees reddish ; first tergite black, with the apical corners broadly and a large apical (median) triangle yellow, each of these marks crossed by a dark band; hind margins of tergites narrowly rufescent ; second tergite yellow at extreme base, second yellow at sides of base, the others black without yellow. In Friese's table it falls nearesst to *A. basalis* Friese, but that has the first four tergites with yellow bands.

Uganda : Entebbe, May 14–25, 1912 (*C. C. Gowdey*).

XLIV.—*Studies in the Iranian Orthoptera.*—III. *New and less-known* Acrididæ *from Southern Iran and Baluchistan.* By B. P. Uvarov, D.Sc., British Museum (Natural History).

This is the third paper in a series * commenced by me nine years ago and devoted to the Iranian Orthoptera.

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* The first two papers are as follows :—

(I.) "Some new and less-known Tettigoniidæ." Ann. Mus. Zool. Acad. Sci. Leningrad, 1929, pp. 623–639, 12 figs.

(II.) "Some new and less-known Acrididæ." Trav. Inst. Zool. Acad. Sci. Leningrad, vol. i, 1933, pp. 187–234, 13 figs, 1 pl.

This term has a bio-geographical meaning, and covers species occurring not only in Iran proper but also in the adjacent countries with the fauna of pronounced Iranian character (Afghanistan, Baluchistan, parts of Kurdistan etc.). The three instalments include only descriptions of new genera, species, and subspecies, as well as critical discussions on some less-known ones. Parallel with this work I am continuing the accumulation of distribution records of Iranian fauna, with a view to produce ultimately an analysis of its composition and probable evolution. In this I am greatly assisted by many friends and colleagues, who are either collecting new material for me or help in solving various taxonomic problems. As a result a catalogue of the fauna is steadily growing, but there are still many parts of the area whence collections are needed. For example, there are practically no data at all for Afghanistan, deserts of Central Iran, Pusht-i-Kuh mountains, etc. Distributional records referring even to commonest species are required from any part of the area, and I would be very grateful for any assistance in this direction, particularly from resident collectors, while I take this opportunity to offer my sincere gratitude to those who are already doing so.

The types of the new species described in the present paper are in the British Museum (Natural History).

Duroniella læviceps, sp. n. (Fig. 1, L.)

♂.—Antennæ a little longer than head and pronotum together, flattened and slightly expanded basally; third joint longer than its apical width; fourth scarcely separated from the third, strongly transverse; fifth transverse; sixth elongate; seventh quadrate; the rest mostly about twice as long as broad.

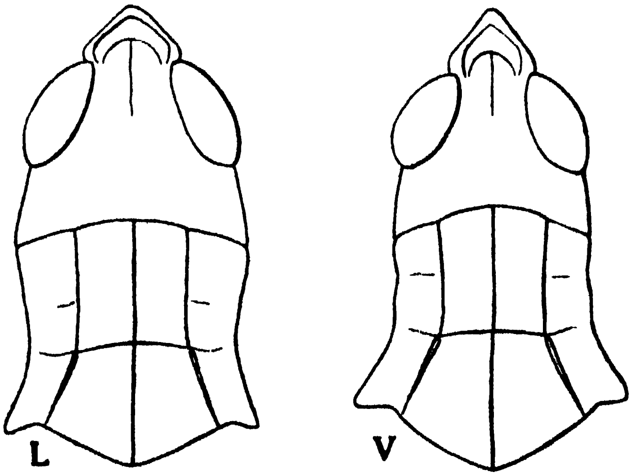
Frontal ridge not punctured, sulcate, weakly expanded between antennæ. Lateral facial carina, viewed laterally, moderately bow-shaped in its upper part. Fastigium of vertex well prominent, a little longer than at the base broad; apical angle less than 90°, scarcely rounded; surface weakly concave, bow-shaped depression weak; margins low, smooth; median carinula very faint; upper surface of the head smooth.

Pronotum long and slender. Disc weakly punctured only at the posterior angles of metazona. Lateral carinæ weakly bow-shaped, incurved in the prozona, more divergent in the metazona obsolescent behind. Median carina low, but acute. Posterior angle obtuse, but not rounded apically. Pleuræ slightly rugulose. Sternum with some scattered, shallow and irregular punctures.

Elytra extending a little beyond the hind knees.

General coloration pale green. Legs, two indefinite sublateral stripes on the head above, and a broad median pronotal stripe are light buff. Elytra with the preradial area and the anal field light green, in the rest brownish, with a series of indefinite brown spots along the middle. Wings very faintly bluish. Hind tibia bluish.

Fig. 1.



L, *Duroniella læviceps*, sp. n., ♀
V, *D. volucris*, sp. n., ♀.

♀.—Much larger than the male. Antennæ very short, scarcely reaching the metazona of pronotum, feebly expanded in more than their basal third, round and not incrassate apically. Fastigium of vertex transverse, with rounded apex; bow-shaped sulcus weak; a slight median carinula. Lateral pronotal carinæ practically straight and parallel in the prozona, distinctly divergent in the metazona.

General coloration pale buff, with brown lateral stripes; pre-radial area of elytra pale green; median stripe of elytra brown, with pale spots.

Length of body, ♂ 12, ♀ 22; pronotum, ♂ 3·2, ♀ 5; elytra, ♂ 14, ♀ 19; hind femur, ♂ 10, ♀ 15 mm.

S. IRAN: Masjid-i-Sulaiman, near Ahwaz, x. 1932, 1 ♂; v.–vii. 1937, 22 ♂♂ (including the type), 46 ♀♀; Abadan, iii. 1933, 1 ♀ (*Dr. S. V. P. Pill*).

S. IRAQ: Amara, 26. vi. 1918, 3 ♂♂, 4 ♀♀; 30. vi. 1917, 1 ♂; 19. x 1917, 1 ♂; Basra, 12. viii. 1918, 1 ♂, 3 ♀♀; 20. viii. 1917, 2 ♂♂, 1 ♀; Mesopotamia, 1 ♂ (*P. A. Buxton*); Persian Gulf, 1 ♀ (*Cummings*).

This new species is very similar to the much more northern *D. gracilis* Uv., differing from it in the shorter and basally expanded antennæ, especially in the male sex, in the somewhat swollen head of the female, and in the strong sexual dimorphism in size. It has a series of colour forms, apparently closely parallel to those observed in *D. gracilis* and *D. lucasi* I. Bol.

Duroniella volucris, sp. n. (Fig. 1, V.)

♂.—Antennæ distinctly longer than head and pronotum together, weakly but distinctly compressed and expanded in the basal quarter; third and fourth joints almost completely fused, forming one elongated joint; fifth and sixth transverse; seventh elongate; eighth quadrate; ninth elongate; the rest strongly elongate, some more than twice as long as broad.

Face strongly reclinate. Frontal ridge in profile slightly projecting between antennæ and very weakly concave lower down; its surface shallowly punctured, sulcate, distinctly expanded between antennæ. Lateral facial carina regularly and weakly bow-shaped. Fastigium of vertex strongly prominent, longer than at the base broad; apical angle less than 90°, well rounded; surface punctured, weakly concave, with weak bow-shaped depression; margins low, convergent behind. Upper surface of the head punctured and rugulose; median carinula irregular, but distinct and long.

Pronotum slender, somewhat constricted. Disk distinctly, though shallowly, punctured. Lateral carinæ very distinct, in the prozona practically straight and almost parallel, in the metazona strongly divergent and weakly excurved, almost reaching hind margin. Median carina distinctly raised throughout. Posterior margin broadly rounded. Pleuræ strongly rugulose. Sternum with small scattered punctures.

Elytra extending to the middle of hind tibiæ.

General coloration dirty pale brown, mottled and dotted with brown. Dorsum with a broad pale stripe. A dark brown lateral stripe runs from the eyes along the upper edge of lateral pronotal lobe of pronotum on to the elytron, where it is bordered from below by an ivory-white preradial stripe. Wings colourless, with darkish veins. Hind tibia dirty white, with pale brown dots.

♀.—Distinctly larger than the male. Antennæ a little shorter than head and pronotum, distinctly expanded in their basal third, narrowed apically. Fastigium of vertex about as long as at the base broad, bow-shaped sulcus weak; median carinula irregular but distinct. Lateral pronotal carinæ very weakly incurved in the prozona. Coloration of the same type as in the male.

Length of body, ♂ 17, ♀ 22; pronotum, ♂ 3·5, ♀ 4·5; elytra, ♂ 17, ♀ 22; hind femur, ♂ 9·5, ♀ 13·5 mm.

S. Iran: Abadan, iii. 1933, 1 ♀; iii.–iv. 1934, 4 ♂♂ (including the type), 8 ♀♀; i. 1935, 1 ♀ (*Dr. S. V. P. Pill*). Mohammerah, River Karun, iii.–iv. 1917, 1 ♂ (*R. C. Mabbs*).

S. Iraq: Amara, 10–12. v. 1917, 1 ♂, 1 ♀ (*C. F. C. Beeson*); 1–11. v. 1918, 1 ♂, 3 ♀♀ (*P. A. Buxton*); Qurnah, River Tigris, 20. v. 1918, 1 ♀ (*P. A. Buxton*); Fao, 1891, 6 ♀♀ (*D. Cumming*).

This is a very distinct species, because of its very slender habitus and long wings. The series before me is very uniform in coloration, except that in some females the sides of body are pale green.

Sphingonotus decarinatus Uvarov, 1933.

1933. *Sphingonotus satrapes decarinatus* Uvarov, Trav. Inst. Zool. Acad. Sci. U.R.S.S. vol. i. p. 200.

1937. *Sphingonotus satrapes decarinatus* Mistshenko, 'Eos,' vol. xii. pp. 92, 278.

I have considered this large *Sphingonotus* as merely a subspecies of *S. satrapes* Sauss., replacing the typical form in S.W. Iran, but I have now before me specimens of the latter taken in the same locality as *decarinatus* (Masjid-i-Sulaiman, near Ahwaz, *Dr. S. V. P. Pill*), which makes this view untenable. Moreover, the differences between the two insects, as summarized by Mistshenko (*l. c.*), are amply sufficient to be regarded as specific.

Calliptamus balucha, sp. n. (Fig. 2, B.)

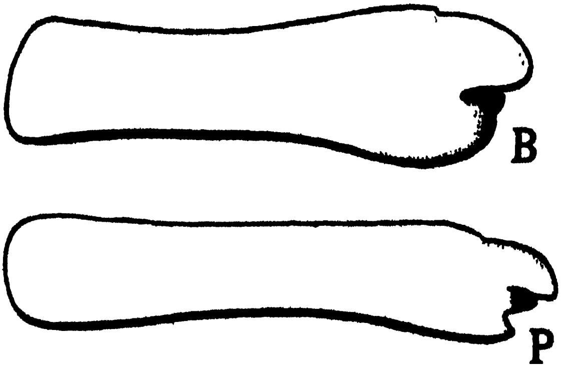
A very small species, with the male cerci similar to those of *C. turanicus* Tarbinksy, 1930, but differing from it in the coloration of hind femora and tibia, as well as in the size.

♂.—Antennæ longer than head and pronotum.

Frontal ridge flat, and in the neighbourhood of the ocellum even slightly concave. Fastigium of vertex narrow, parallel-sided, concave. Vertex between eyes with a short but very distinct carinula.

Lateral pronotal carinæ well developed, straight, weakly divergent backwards. Typical sulcus placed distinctly behind the middle. Posterior angle of pronotal disc obtuse, not rounded. Prosternal spine slightly inclined backward, its sides somewhat flattened.

Fig. 2.



B, *Calliptamus balucha*, sp. n., male cercus ;
P, *C. persa*, sp. n., male cercus.

Elytra narrowed apically, scarcely reaching the base of hind knees.

Cercus viewed in profile distinctly widened apically ; upper apical lobe with the lower angle rounded ; median lobe reaching just beyond the middle of the upper ; lower lobe scarcely separated from the median, very broadly rounded below.

General coloration dirty pale brown, with some lighter spots on the elytra. Hind femur externally with black dots along the margins of the externo-median area; internally light sanguineous, with two incomplete blackish fasciæ; knees with brown semilunar spots on both sides. Hind tibia light sanguineous. Wings light rose basally.

♀.—Distinctly larger than the male. Lateral pronotal carinæ often slightly excurved.

Length of body, ♂ 16, ♀ 26; pronotum, ♂ 4, ♀ 7; elytra, ♂ 8·5, ♀ 16; hind femur, ♂ 9, ♀ 15·5 mm.

Baluchistan: Quetta, 5500 ft., 23. vii.–10. viii. 1929, 2 ♀♀; Ziarat, 8000 ft., 6. viii. 1929, 1 ♂, type (*J. W. Evans*); Charman, 17. viii. 1930, 1 ♀; Urak Valley, 16 m. from Quetta, 7000 ft., 24. viii. 1930, 2 ♀♀; Hanna Valley, 6000 ft., 14. ix. 1930, 1 ♀ (*W. H. Evans*); Ziarat, 7. viii. 1931, 2 ♀♀ (*M. Sharif*).

This species is very similar in the coloration of hind legs to *C. italicus*, but the structure of the male cercus is as in *C. turanicus* Tarb.

Calliptamus persa, sp. n. (Fig. 2, P.)

Under medium size, similar in the shape of male cerci to *C. tenuicercis* Tarbinsky, 1930, but posterior femora deep cherry-red on the inner side, and posterior tibiæ light sealing-wax red.

♂.—Antennæ distinctly longer than head and pronotum. Frontal ridge weakly convex. Fastigium of vertex with a distinct narrow depression, which is slightly widened towards the parabolic apex. Vertex between eyes with a distinct short carinula.

Lateral pronotal carinæ well developed throughout, weakly excurved. Typical sulcus placed slightly behind the middle. Posterior angle of pronotal disc obtuse, rounded. Prosternal spine somewhat narrowed apically and directed weakly backwards.

Elytra little narrowed apically, just reaching the apex of hind femora.

Cercus, viewed in profile, practically parallel-sided throughout, fairly narrow; upper apical lobe slightly decurved, with acute lower angle; median lobe reaching a little beyond the middle of the upper; lower lobe very small, almost rectangular.

General coloration greyish buff, with scarcely any pattern except that elytra are faintly spotted with very pale brown. Hind femur externally without markings; internally almost wholly deep cherry-red (passing into blackish), except the preapical portion, which is light yellowish; upper inner area with two faint brown fasciæ; lower inner area suffused with cherry-red along its inner edge; knees with brownish semilunar spots on both sides. Hind tibia internally light sealing-wax red. Wings bright rose basally.

♀.—As the male, only larger.

Length of body, ♂ 21, ♀ 30; pronotum, ♂ 4·7, ♀ 6·5; elytra, ♂ 16·5, ♀ 22·5; hind femur, ♂ 13, ♀ 17 mm.

The large extent of the dark colour on the inside of hind femur in this species makes it superficially similar to *C. siculus* (Burm.), with which it shares also the red coloration of hind tibiæ. That dark colour is, however, completely black in *C. siculus*, while in *C. persa* it is beautiful deep cherry-red, exactly as in *Caloptenopsis glaucopsis* (Walk.). Moreover, the cerci of *C. siculus* are very distinct in shape, being well dilated apically and provided with a strongly projecting large lower apical lobe. In the structure of the cerci the new species approaches very closely *C. tenuicercis* Tarb., but differs widely from it in the coloration of hind femora and tibiæ.

The typical series of *C. persa* has been taken by Dr. Pill, together with much more numerous *C. siculus deserticola* Voss., and the two can be separated at a glance, *C. persa* being a much smaller and sturdier insect, with relatively much shorter elytra.

In some of the paratypes dark pattern of the elytra is more pronounced, while one male has dark dorsal side with the parallel light stripes of the f. *marginella*, known to occur in practically all species of the genus.

Described from a series of 8 ♂♂ and 2 ♀♀ taken at Masjid-i-Sulaiman, near Ahwaz, S.W. Iran, v.–vii. 1937 (*Dr. S. V. P. Pill*).

Genus SPHODROMERUS Stål, 1873.

1873. *Sphodromerus* Stål, Rec. Orth. i. p. 72.

1902. *Sphodromerus* Jacobson, Priamokr. i. Lozhnoset. Ross. Imp. pp. 173, 315.

1914. *Kripa* Kirby, Fauna Brit. India, Acrid. pp. 195, 257 (*syn. nov.*).
1922. *Kripa* Uvarov, Trans. Ent. Soc. London, 1922, pp. 118, 124 (partum !).

The genus *Kripa* has been founded by Kirby on a species from N.W. Punjab, known to the author by a single female specimen. I have now before me a series of specimens, including a male from Baluchistan, which I consider conspecific with the genotype, *K. undulata* Kirby, though they may differ subspecifically (see below). A study of this series, together with the type of *K. undulata*, makes it impossible to regard this species as belonging to a genus distinct from *Sphodromerus*, of which I know the majority of the described species, including the genotype, *S. serapis* Serv. Therefore *Kripa* Kirby becomes a synonym of *Sphodromerus* St.

On the other hand, I attempted in 1922 (*l. c.*) to redefine *Kripa* on the basis of another species, *cœlesyriensis* G. T., which I considered congeneric with *undulata*. This view I am unable to uphold now, when *undulata* is better known and when it is clear that *cœlesyriensis* cannot be included into *Sphodromerus* where *undulata* belongs. This makes it necessary to erect for *cœlesyriensis* a new genus, which, together with *Sphodromerus*, differs from *Calliptamus* in the male cerci armed with a single subapical tooth. The following comparative table shows the differences between *Sphodromerus* and the new genus:—

SPHODROMERUS Serv.	METROMERUS, gen. nov.
Type: *Calliptamus serapis* Serv.	Type: *Caloptenus cœlesyriensis* Giglio-Tos, 1893.
Pronotum more or less convex above; lateral carinæ either obsolete throughout or weakly developed in the prozona only.	Pronotum weakly tectiform above; lateral carinæ well distinct, though irregular, in the prozona and at least in the anterior part of the metazona, but not reaching the hind margin.
Hind femur very broad; upper carina strongly serrate; lower outer area distinctly widened behind the middle, with the lower carina usually serrate; pregenicular constriction very distinct; outer genicular lobe short and broad.	Hind femur moderately broad (not broader than in *Calliptamus*); upper carina scarcely serrulate; lower outer area not widened behind the middle, with the lower carina smooth; pregenicular constriction weak; outer genicular lobe elongate, not broad.
Hind tibia with six (seldom seven) external spines.	Hind tibia with nine (seldom eight) external spines.

It will be seen from the table that the structure of pronotum in *Metromerus* represents only a slight modification of that observed in *Calliptamus*, while in *Sphodromerus* a much greater degree of divergence exists. The structure of the hind leg (general shape of the femur; shape of genicular lobe; number of tibial spines) in *Metromerus* is exactly as in *Calliptamus*, and one might be tempted not to separate these two genera were it not for a substantial difference in the armature of the male cercus. In this respect *Calliptamus* obviously represents a higher degree of specialization than either *Sphodromerus* or *Metromerus*, which share the one-toothed type of cerci with a group of genera (*Caloptenopsis*, *Acorypha*, etc.) extremely well developed in the savannas of Africa, with some representatives in India.

Sphodromerus undulatus (Kirby, 1914).

1914. *Kripa undulata* Kirby, Fauna Brit. India, Acrid. p. 257, fig. 137.

Rose-coloured hind wings distinguish this species from others known, except *S. sanguiniferus* Rehn (from Somaliland), in which the wings are of the same colour but very strongly abbreviated.

♂.—Antennæ slender, composed of strongly elongated joints (exact length unknown, as the antennæ in the type are incomplete).

Face oblique. Frontal ridge viewed in profile straight from the antennæ downwards; viewed from the front it has straight margins gradually divergent to the clypeus, not reaching it, but perceptible for some distance below the ocellum. Face between the frontal ridge and the facial keels distinctly concave (convex in most other species of the genus). Fastigium of vertex strongly prominent forwards, scarcely sloping, practically parallel-sided, narrow, sulcate.

Pronotum comparatively long, very little constricted in prozona, merely narrowed forwards. Disc very weakly convex. Median carina fine, but distinct. Lateral carinæ in the prozona very weak, but perceptible, somewhat divergent and weakly excurved, in metazona obsolete. Prosternal tubercle straight, acutely conical.

General coloration light ochreous brown. Elytra with some irregular oblique brownish-grey fasciæ in the apical portion. Wings light rose basally. Hind femur inside with a large black spot edged below by sanguineous colour; lower inner area slightly sanguineous along the edges; inner knee lobe sanguineous with black base: outer knee lobe ivory-white with black base; semilunar spots on both sides of the knee black. Hind tibia sanguineous on the inner side.

♀.—In the female type hind tibiæ are not sanguineous but light red, and there is no sanguineous colour on hind femora, but it appears that the specimen has suffered an immersion in alcohol which has changed the colour of red parts. In any case, the series of specimens before me now shows no divergence from the type in any detail except this slight colour difference, and I do not hesitate to regard them as definitely conspecific with the type. Should it be proved in future that the colour of hind tibiæ changes according to geographical distribution, then the Baluchistan specimens with sanguineous tibiæ will have to be regarded as a subspecies distinct from the Punjab form with light red tibiæ.

XLV.—*A new* Œcomys *from Trinidad.* By R. W. HAYMAN, Department of Zoology, British Museum (Natural History).

AMONG other small rodents from the West Indian island of Trinidad recently submitted for identification to the British Museum (Natural History) by Dr. H. Hediger, of the Basle Museum, occur five specimens of what appears to be a new species of *Œcomys*. The new form may be known as

Œcomys splendens, sp. n.

Type.—B.M. no. 1937.11.11.2, ♂, skin and skull (skinned from spirit). Collected at Mayaro, S.E. Trinidad, between July 1936 and June 1937. Original number 116.

A medium-sized long-tailed species, with long thick fur of a rich reddish-chestnut hue, more richly coloured than any *Œcomys* hitherto described. The hairs of the dorsal surface (10–12 mm, long) are slaty-grey from the base for about three-quarters of their length, with reddish-chestnut tips. In the mid-dorsal area the general tinge is darkened by the presence of many hairs of the same length as the majority, but black-tipped instead of reddish. The flanks are entirely without this sprinkling of black. There is a clear line of demarcation between the chestnut of the flanks and the clear white under surface, the hairs of which are slaty at the base. The feet and tail are discoloured by spirit, but the tail is uniformly clad with short brown hairs and is slightly pencilled at the tip, as in other members of the genus.

The nearest forms, geographically speaking, are:—(*a*) *rosilla* Thomas, from Lower Orinoco, E. Venezuela; smaller, dull-coloured, ventral surface buffy ochraceous: (*b*) *caicaræ* Allen, Central Venezuela; ventral hairs white to base: (*c*) *nitedulus* Thomas, British Guiana; smaller, pale colour, ventral hairs white to base: (*d*) *rutilus* Anthony, British Guiana; small, ventral hairs white to base: (*e*) *guianæ* Thomas; browner, slightly smaller, ventral hairs soiled buffy white: (*f*) *rex* Thomas, British Guiana; larger, duller colour, strongly developed supra-orbital ridges and angular skull.

The Trinidad form fits none of these. In dorsal colour *rex* most closely approaches the new form, but has a more grizzled, less rufous coat, and is distinguished, in addition, by its larger size and strongly developed supra-orbital ridges. In size and skull-characters *guianæ* is nearer, but has a tawny coat and buffy ill-defined ventral surface.

Dimensions of *splendens* (in mm.):—

	Head and body	Tail.	Hind foot.	Ear.
Type ♂, 116.....	110	146	25	16
♂, 115.....	111	145	24	15
♀, 117.....	99	132	24	16
♀, 118.....	93	139	23	15

Skull of type: condylo-basal length 29 mm.; palatal length 16; zygomatic breadth 15·5; mastoid breadth 13·1; palatal foramina 5·8; maxillary tooth-row 5.

Dr. Hediger, who has kindly presented the type and numbers 115 and 117 to the British Museum (Natural History), states that the specimens had fallen into test-holes bored by geologists in the more or less forested region at Mayaro. This appears to be the first record of the genus in Trinidad, although the closely related *Oryzomys* is represented on the island by several distinct forms.

XLVI.—*A new Crested Bat* (Chærephon). By R. W. Hayman, Department of Zoology, British Museum (Natural History).

Among a small collection of mammals—chiefly bats—made recently in N.E. Rhodesia by Mr. D. Gordon Lancaster, and presented by him to the British Museum, there occurs a specimen of *Chærephon* with a long bicoloured crest and a pure white underside. Careful comparison with previously described forms shows that Mr. Gordon Lancaster's specimen belongs to an undescribed form, for which I now propose the name

Chærephon lancasteri, sp. n.

Type.—B.M. no. 1937.12.8.25. Original number 724. ♂ skin and skull, collected August 1936 at Lunzi River, Lundazi District, Loangwa Valley, N.E. Rhodesia, by D. Gordon Lancaster.

Description.—Closely similar in size to *C.* (*Lophomops*) *shortridgei* Thomas, slightly larger than *C.* (*L.*) *chapini* Allen. Crest long and bicoloured as in both these forms. Body above greyish drab, the hairs paler at the bases and slightly paled at the tips, thus producing a not very noticeable frosted effect. On the nape the hairs are notably paler throughout. The aural crest, rising from the back of the deep connecting membrane between the ears, is strongly bicoloured. The basal third is dark brown, the remainder pale buff, much as in *shortridgei*. Its length at the centre is 14·9 mm. A triangular patch on the crown, with its apex at the base of the centre of the tuft, is naked, and is entirely covered by the crest when laid flat. On the entire underside every hair is pure white from base to tip, including the narrow band along the edge of the membrane from humerus to groin. The wing-membranes are whitish, in strong contrast with the interfemoral membrane, which is dark greyish brown. The membrane connecting humerus and femur is heavily spotted, as in *C. limbatus* Peters and as described in *chapini*. The skull and teeth present no points of special interest. The skull in size and proportions is close to that of typical *Chærephon pumilus*. P^2 is in the tooth-row, and there are four lower incisors, the inner pair slightly bifid.

Comparison.—*Chærephon lancasteri* differs from *chapini* Allen, from Faradje, N.E. Congo (the first member of the genus described with strongly developed crest), in the following respects:—*chapini* is smaller, with a forearm of 34 and 37 for type and topotype, against 39 in *lancasteri*; skull-length of 15·5 and 16, compared with 17 in the Rhodesian form; upper tooth-row 5·4 and 5·8, against 6·2. The body-colour of *chapini* is different, being described as pale cinnamon-brown above, fur whitish basally and below greyish brown, middle of belly whitish. The wing-membranes of *chapini* and *lancasteri* appear to be similar in colour.

C. (*L.*) *cristatus* Allen, from Boma, mouth of the Congo, has a short crest (9 mm.), is russet above, dark cinnamon-brown below, and has a forearm of 36.

C. (*L.*) *abæ* Allen, from Aba, N.E. Congo, has a short crest, an entirely different type of inter-aural membrane, is much larger (forearm 43), and is dark brown above and below.

C. (*L.*) *shortridgei* Thomas, from Ovamboland, S.W. Africa, is about the same size as *lancasteri*, but apart from the crest is quite distinct in colour. The dorsal surface is greyish drab rather heavily frosted by the pale hair-tips. There is a marked contrasting band of chestnut along the flanks above, between humerus and femur. Below it is pale drabby, with a pinkish tinge, only the tips of the hairs being a dirty whitish. All the membranes are of a uniform greyish hue without contrast.

C. (*L.*) *nigri* Hatt, from Bourem, Cercle de Timbouctoo, French West Africa, has a short crest (5·5 mm.), is smaller (forearm 36 mm.), has brown membranes, and is grey above and below.

C. (*L.*) *langi* Roberts, from N. Bechuanaland, in size is close to *chapini*, *shortridgei*, and the new form, having a forearm of 37·5 and upper tooth-row 6·1 mm. The colour above is dusky drab, below lighter, but only white along lower part of abdomen and along border of membrane below between humerus and femur. It has a unicoloured short crest.

Measurements of lancasteri (*type*).—Head and body 52 mm.; tail 34·8; hind foot 6·3; ear 15 mm. height from meatus, width 12·5, connecting membrane between ears 6 mm. high; length of crest 14·9; forearm 39; third metacarpal 38·8, first phalanx 15·7, second phalanx 15·7; fourth metacarpal 37, first phalanx 12·5, second phalanx 8·5. Skull: total length 17; condylo-basal length 16·7; mastoid breadth 9·3; zygomatic breadth 9·7; breadth at m^3 7·4; upper tooth-row 6·2; greatest depth of skull 7·2.

Notes.—Allen's subgenus *Lophomops*, for *chapini*, *cristatus*, and *abæ*, was based on two characters: (1) the long aural crest arising from the back of the connecting membrane between the ears; (2) the reduction of the lower incisors to two. Dealing with the latter character first, it is only necessary to point out that Allen, on p. 464, in discussing *cristatus*, states that in the type and topotypes certain of the incisors had obviously been shed in life, and continues, "in the *Lophomops* group the lower incisors are doubtless normally 2—2." Allen does not mention the incisors of his third species of *Lophomops*, *abæ*. In *shortridgei* there are only two lower incisors, but they are obviously one inner and one outer. In other species of *Chærephon* some of the lower incisors are often found to have been shed.

The second character used (with some diffidence, it is true) by Allen for *Lophomops*, the erectile crest between the ears, has already been thoroughly dealt with in detail by Braestrup (1933). This author has shown that a crest, of greater or lesser length, may be developed at times of sexual activity by males of any species of *Chærephon*, and points out that Allen's subgenus must be given up, a course hinted at by Thomas in discussing *shortridgei*. While agreeing with Braestrup that the crest alone, being restricted to males at certain seasons, is itself not diagnostic in distinguishing forms, I think that when strongly developed crests such as are found in *chapini*, *shortridgei*, and *lancasteri* are associated with other differences in size and colour, these forms should be distinguished. Probably it will be found, when further collecting has shed more light on the distribution of these long-crested forms, that they may be linked as races of *chapini*. Until then, in view of the present wide gaps in their known distribution, it seems best to treat them as species. I have much pleasure in associating with this Rhodesian form the name of Mr. Gordon Lancaster, in appreciation of his frequent assistance to the Museum.

Addendum.—Comparison of Allen's description of *abæ* with the types of *major* Trouessart (type-locality First Cataract of the Nile) and *emini* de Winton (type-locality Usambiro, Tanganyika), two species mentioned by Allen as having been considered in relation to *abæ*, has been made. Allen was misled by de Winton's inaccurate description of the ears of *majori* and *emini* as united, into believing the central separate lappet of *abæ* to be distinctive. Careful examination of the types of *majori* and *emini* shows that they have, in fact, quite the same central lappet, not directly uniting the ears, as Allen described and figured. The absence of crest in the type-specimens (labelled male in *emini*, unsexed in *major*) is no proof that such is not found at times, in view of Braestrup's investigation of this character in *Chærephon*. But in a series of *emini* collected in Tanganyika in 1919 by A. Loveridge are three males, one of which, an old animal, as shown by the teeth, has a well-marked brown tuft or crest as shown in *abæ*. Younger males are without it. In other respects, namely size and colour, the three named forms agree well. Braestrup suggested the possibility of the three being closely related, and I have little doubt that both *emini* and *abæ* are synonyms of *major*.

REFERENCES.

chapini Allen, 1917, Bull. Am. Mus. N. H. xxxvii. p. 461.
cristatus Allen, 1917, *op. cit.* p. 463.
abæ Allen, 1917, *op. cit.* p. 464.
shortridgei Thomas, 1926, P. Z. S. p. 289.
nigri Hatt, 1928, Bull. Soc. Zool. France, liii. p. 374.
langi Roberts, 1932, Ann. Transv. Mus. xv. p. 17.
(The above were described as *Lophomops*.)
major Trouessart, 1897, Cat. Mamm. i. p. 147.
emini de Winton, 1901, Ann. & Mag. Nat. Hist. (7) vii. p. 40; Braestrup, F. W., "On the Taxonomic Value of the Subgenus *Lophomops* (Nyctinomine Bats), with Remarks on the Breeding Times of African Bats," Ann. & Mag. Nat. Hist. (10) xi. pp. 269–274 (1933).

XLVII.—*French Trichoptera.*

By MARTIN E. MOSELY.

THE recent publication of a catalogue of the French Trichoptera or caddis-flies renders it desirable that subsequent captures in that country, if of any importance, should be recorded, and so made available should any supplement to the catalogue be contemplated.

Two small collections are noticed in this paper, the one made by Mr. A. W. McKenny Hughes in the Central Plateau, the Departments covered being Puy-de-Dôme, Corrèze, and Dordogne; the other by Mr. B. P. Uvarov in the immediate vicinity of Samoens, in Haute Savoie.

From Dordogne Mr. McKenny Hughes obtained examples of a *Lepidostoma* which I have doubtfully determined as *fimbriatum* of Ed. Pictet. a new record for the Department.

It is perhaps questionable whether this species should not be considered as a mere variety of *hirtum*. I have been unable to trace any difference in the genitalia between the two, and the difference in the arrangement and numbers of scales on the wings, the character on which the distinction between the two species has been based, seems hardly of sufficient importance to warrant the erection of a distinct species.

Stenophylax spinifer appears to be a new record for the Puy-de-Dôme, and most of the records for the Dordogne are also new, as little previous collecting of Trichoptera has been made in the Department.

Of the collection made by Mr. Uvarov at Samoens the most interesting species is undoubtedly a male example of *Drusus mixtus* Pict. This has hitherto been represented in the British Museum collection merely by the fragment presented by Pictet himself to Curtis, and which is useless for the purpose of a comparison. Besides this Mr. Uvarov's collection contains no fewer than four species of *Rhyacophila*.

Trichoptera collected by Mr. A. W. McKenny Hughes.

Family LIMNOPHILIDÆ.

Drusus annulatus Steph.—P.-de-D.: Royat, 22. v. 1937.
Drusus discolor Ramb.—P.-de-D.: Royat, 22. v. 1937.

Hypnotranus picicornis Pict.—P.-de-D.: Royat, 22. v. 1937.
Limnophilus centralis Curtis.—Corrèze: Tulle, 21. v. 1937.
Stenophylax spinifer McLachl.—P.-de-D.: Royat, 22. v. 1937.

Family SERICOSTOMATIDÆ.

Goëra pilosa Fab.—Dordogne: Eyzies, 19. v. 1937; Domme, 18. v. 1937; Sarlat, 17. v. 1937; Lisle, 15. v. 1937.
Lepidostoma fimbriatum Ed. Pictet.—Dordogne: Sarlat, 17. v. 1937; Lisle, 15. v. 1937.
Micrasema longulum McLachl.—P.-de-D.: Royat, 22. v. 1937.
Micrasema moestum Hagen.—Dordogne: Brantôme, 14. v. 1937.
Notidobia ciliaris L.—Dordogne: Brantôme, 14. v. 1937.
Sericostoma personatum Spence.—Dordogne: Lisle. 15. v. 1937.
Silo nigricornis Pictet.—Dordogne: Lisle, 15. v. 1937.

Family PSYCHOMYIDÆ.

Psychomyia pusilla F.—Dordogne: Eyzies, 19. v. 1937.
Tinodes wæneri L.—Dordogne: Domme, 18. v. 1937; Lisle, 15. v. 1937.

Family PHILOPOTAMIDÆ.

Chimarrha marginata L.—Dordogne: Brantôme, 14. v. 1937.
Philopotamus montanus Don.—P.-de-D.: Royat, 22. v. 1937.
Philopotamus variegatus Scop.—P.-de-D.: Royat 22. v. 1937.

Family RHYACOPHILIDÆ.

Rhyacophila septentrionis McLachl.—P.-de-D.: Royat, 22. v. 1937; Dordogne: Domme, 18. v. 1937.

Trichoptera collected by Mr. B. P. Uvarov at Samoens, Haute Savoie, 700 m., viii.-ix. 1937.

Family LIMNOPHILIDÆ.

Drusus mixtus Pict.
Drusus discolor Ramb.

Family SERICOSTOMATIDÆ.

Micrasema tristellum McLachl.

Family ODONTOCERIDÆ.

Odontocerum albicorne Scop.

Family PHILOPOTAMIDÆ.

Wormaldia occipitalis Pict.

Family RHYACOPHILIDÆ.

Rhyacophila torrentium Pict.
Rhyacophila proxima McLachl.
Rhyacophila præmorsa McLachl.
Rhyacophila vulgaris Pict.

XLVIII.—*The Chronology of the Pleistocene Sea-levels.* By F. E. ZEUNER, Ph.D., Department of Geochronology, London University Institute of Archæology.

A QUESTION which plays an important part in all glaciation theories is whether an increase of precipitation, or a lowering of temperature, caused the extension of the Scandinavian and alpine glaciers. Geological and glaciological investigations have shown that the *nevées* (*Firnfelder*) of the Alps were not fuller during the Pleistocene than they are now. This means that not an increase of precipitation, but a lowering of temperature, was the original cause of a glaciation, and theories which do not agree with these observations can no longer be regarded as satisfactory. Furthermore, the well-known Austrian meteorologist W. Köppen (1924), depending on a great number of observations in the Alps and elsewhere, was in the position to prove that it is not the cold of the winter, but the coolness of the summer, that causes an increase in the volume of ice, and he concluded that periods of cool summers (which are favourable to a preservation of ice and snow) initiated the glaciations.

It was from this point of view that the variations of the intensity of solar radiation, as calculated by M. Milankovitch (1930), were applied to the results of geologists bearing on the fluctuations of the climate of Central Europe during the Pleistocene, and again it was Köppen who first realised that Milankovitch's curves for the summer radiation of 65°, 55°, and 45° N. lat. reproduced correctly and in great detail the fluctuations in the extension of ice during the Pleistocene (figs. 1, 2, facing p. 404).

It is, however, important to note that the more the ice expanded, the more anticyclonic conditions developed over a large portion of Europe (Zeuner, 1937), and many of the Atlantic depressions were compelled either to pass over the Mediterrranean or to move northwards into the northern part of the Atlantic where they were liable to cause heavy snow-falls over the high ridges of the Scandinavian mountains. Thus, the latter experienced an increase of precipitation once a glaciation had begun, and, though this was a secondary effect, it greatly intensified the glaciation of Scandinavia and Central Europe, and contributed decidedly to its extension in space and time.

It is natural that when conditions changed and a period of hot summers began the ice did not immediately melt away. It lagged behind. The amount of this retardation is known only for the last phase of the last glaciation (Würm 3), when it was about 5000 years (Zeuner, 1935, p. 364). It must have been more during the greater glacial phases.

Continuous research of geologists for more than 15 years has much advanced our knowledge concerning the intensity of the individual glacial phases in Central Europe and of their correlation with the minima of summer radiation. Using these results and supplementing them by his own extensive studies, W. Soergel (1937) has recently succeeded in constructing a glaciation curve which shows the fluctuations in the extension of the Scandinavian ice-sheet for Europe between the 11th and 19th degrees E. long. (fig. 3). It does not matter if one agrees or not with Soergel in every detail as to the extension of the ice-sheets at certain moments; there is no doubt that his curve is a reliable synthesis of what is at present known. It shows well how the phases of ice-advance, initiated by periods of cool summers, coalesce to the well-known main glacial periods, *i. e.*, Günz, Mindel, Riss, and Würm, of which Günz was decidedly unimportant, whilst Mindel and Riss were the two chief glacial periods. It is important to note that the first phase of Würm proves to be comparatively independent of the two later phases, which, in turn, are more closely connected with each other.

It is not necessary here to go into details or to investigate in which respects conditions in West Europe differed from those established for the zone between 11° and 19° E. long. For the purpose of the present paper the curve offers a sufficiently accurate basis.

It is a commonly accepted view that the glaciations were approximately contemporary over the northern hemisphere. This view is confirmed by the radiation curves, but one has to make an allowance for the locally varying amount of retardation of the ice-recession. This retardation, when it was considerable, led to a fusion of the remainder of a previous ice-sheet with that of the following phase. This phenomenon plays a very important part; it, for instance, explains also why in the Alps where the glaciated area was comparatively small (compared with that of the Scandinavian ice-cap) the individual phases of each main glaciation can be separated. This is less so in the area of the Scandinavian ice, where, however, the phase Würm 1 still appears as almost a separate glaciation.

R. A. Daly calculated the volumes of the various ice-caps of the last glaciation (*i. e.*, Würm). He found 21,600,000 cubic kilometres for the Labrador–Keewatin ice-cap of North America. This mass is over four times as large as the volume of the Scandinavian cap (5 million cubic kilometres approximately). It is obvious from these figures that the retardation of the recession must have been considerably greater for the Labrador–Keewatin cap than it was for the Scandinavian cap, so that a very large quantity of ice dating from the radiation phase Würm 1 must have survived the interstadial Würm 1/Würm 2 in North America.

Daly, as well as most other Pleistocene geologists, is convinced that the fluctuations of the sea-level during the Pleistocene largely depend on the absorption of water in the ice-caps of the respective glacial phases (Daly's "glacial control theory"). If it were possible to determine the changes in the total volume of ice for the whole earth one at the same time would obtain the fluctuations of sea-level as far as they depend on changes in the volume of ice accumulated. Moreover, there being no retardation between the absorption of water in the ice-caps and the adjustment of sea-level, the stages of the latter could be dated in relation to glaciations as well as in years by means of the radiation curves.

We are still far from being able to do this accurately. Nevertheless, a first attempt at approximation is undertaken in the following lines, not because the author considers the subject as sufficiently advanced for an extensive treatment but in order to show (1) that at least the fluctuations of sea-level in the Mediterranean are in complete agreement with the detailed chronology of the European Pleistocene, and (2) that it is possible to bring the eustatic movements into relation with the fluctuations of solar radiation, so that, one day, one might be able to date Pleistocene sea-levels relatively, as well as approximately in years, over the whole earth. This is, of course, merely a chance, but it has to be admitted that A. C. Blanc's recent investigations on the fluctuations of sea-level and climate in Italy have yielded results which, even in details, confirm completely and in a most surprising way the applicability of the radiation curves to the Mediterranean area.

Had there been glacial periods in Europe only, Soergel's glaciation curve, whose amplitudes are directly related to the volumes of ice, could almost be taken as the curve for the fluctuations of the sea-level, with the same distribution of maxima and minima, though with amplitudes modified owing to the fact that the extension is given as a linear measure in Soergel's curve, whilst the volume of absorbed water is a cubic measure.

The North American and the Antarctic glaciation areas are the two others of importance that have to be considered. Of these, the North American one experienced the same fluctuations of solar radiation as did the Scandinavian centre, and radiation maxima and minima were contemporaneous for the same degree of latitude in Scandinavia and North America respectively. It has, however, been said above that the effect of retardation was much greater in North America than in Europe, and, although its actual values are not known, it is justifiable to argue that this retardation of melting in North America considerably slowed down the return of the water to the ocean. The interstadial oscillation Würm 1/Würm 2, therefore, will not have caused the sea-level to return to a very high mark. A similar, though slight, oscillation is probable for the interstadial Würm 2/Würm 3, but generally the sea-level was low throughout the Würmian and probably lowest during its first phase, the corresponding radiation minimum being the strongest.

The duplication of the minima of solar radiation during both the Mindel and Riss periods did not find its expression in individualised great advances and retreats of the Scandinavian ice-caps ; they merely appear as oscillations of the ice-margin. In both cases the second oscillation was the stronger. The short-timed interstadials Mindel 1/Mindel 2 and Riss 1/Riss 2, respectively, thus need not have much affected the ocean level, and if they did so to any appreciable amount it was for a short time only.

Whilst the Riss and Mindel were distinctly periods of very low sea-levels, the phases of Günz were rather weak and short, and they need not have absorbed great quantities of ocean water. This is amply confirmed by geological and palæontological evidence, and agrees with the intensity of the corresponding radiation minima.

Before considering the high sea-levels, for which, naturally, evidence is more easily available than for the low ones, a complication has to be introduced. It is the possible effect on the height of the sea-level of the glaciations of the southern hemisphere. Fortunately, there are some data on which an estimate of this influence can be based.

The present volume of the Antarctic ice-cap * is, if one accepts W. B. Wright's figures (1937, p. 413) as a basis for calculation, approximately 12 million cubic kilometres. According to Daly (1935, p. 46) the excess over the present volume of ice, accumulated in the Antarctic ice-cap during the last glaciation, was approximately 4 million cubic kilometres, which is equivalent to one-third of the present volume. If one constructs from Milankovitch's figures (1930) the curve of summer radiation for 75° S. lat. (fig. 4, facing p. 404) it becomes apparent that the first phase of the last glaciation was the most intense of all glacial phases on the Antarctic continent, so that it seems likely that

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* The other glaciated areas of the southern hemisphere are small enough to be neglected in this connection.

at no time of the Pleistocene the excess of ice was more than one-third of the present volume.

A further interesting feature of this curve is that, *in the average*, summer radiation was less than now in Antarctica during the last 600,000 years and that phases of a summer radiation stronger than at present had mostly small maxima and totalled only 177,000 years out of the 600,000 years of the Pleistocene. These periods of warm summers were equally distributed over the whole Pleistocene; there were not less than 17, each averaging about 10,000 years and none of them longer than 15,000 years. With these figures has to be compared the average duration of the phases with summer radiation less than at present, which is 24,000 years. These phases differ little in intensity. In other words, 17 long periods of strong minima of summer radiation alternated with 17 short periods of weak maxima in Antarctica.

Combining this with the result concerning the amount of Antarctic ice during the last glaciation one arrives at the conclusion that the Antarctic ice-cap persisted throughout the whole Pleistocene and that the increase in the volume of ice, as compared with present conditions, is not likely to ever have exceeded one-third of the present volume.

On the other hand, it has to be admitted that a few Antarctic interstadials had, according to the radiation curve, sufficiently warm summers to carry melting beyond the present state. In view of the shortness of these periods, however, and of their comparatively slight intensity, their effect will largely have been compensated by the retardation phenomenon, and if one admits that, in addition to the 4 million cubic kilometres melted since the last glaciation, another 2 million might occasionally have returned to the ocean, such figure would in my opinion amply cover the effect of even the warmest Antarctic interstadials.

Thus, one arrives at the following figures for the changes in the volume of the Antarctic ice-cap during the Pleistocene:—

Approximate minimum volume	10	million	cubic	kilometres.
Present volume	12	„	„	„
Approximate maximum volume	16	„	„	„
Variability	6	„	„	„

At any phase of the Pleistocene not more than 6 million cubic kilometres of ice (water) are likely to have returned to the ocean from Antarctica. In his 'Changing World of the Ice-age,' R. A. Daly has given the latest figures for the dimensions of the various Pleistocene ice-caps. In North America, Europe, and Siberia, 30 million cubic kilometres of ice have vanished since the last glaciation, and 35 million cubic kilometres since the maximum glaciation *. These figures have to be compared with the 4 million cubic kilometres of Antarctic deglaciation since the last glaciation and with 6 million cubic kilometres as the possible maximum amount.

It clearly follows from these figures that the contribution of Antarctica to the Pleistocene eustatic fluctuations of sea-level was much smaller than one would expect, being only between 13–17 per cent.

This figure explains why the Pleistocene sea-levels appear to be related to the glacial phases of the northern hemisphere only. Indeed, considering the Pleistocene sea-levels of the Mediterranean, one is justified in comparing them directly with the fluctuations of the volume of water absorbed by the ice-caps of the northern hemisphere.

It was shown above that Soergel's glaciation curve, though established for a restricted area and though disputable in certain details, roughly shows the relative volumes of the succeeding Scandinavian ice-caps. The generalization has already been carried out above for the cold phases and low sea-levels. It now remains to find out at which times the sea-level could have been higher than now. Going backwards from the present, the first period of complete deglaciation was that of the interglacial Riss/Würm, which, according to Soergel, appears to have been short. It is, however, possible that he overestimated the importance of the cool phase Pre-Würm (now called Riss 3 by Soergel) and that the interglacial Riss/Würm has to be subdivided into an earlier cool-temperate phase, a short cold oscillation (*i.e.*, Pre-Würm), and a final phase with very warm summers and complete deglaciation. It is mainly to the latter that the latest high sea-level would correspond.

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* There is reason to believe that this estimate is too small. Compare explanation of fig. 5 on p. 404.

Going further back into the past, there is the "Great Interglacial" between Mindel and Riss, during which—all Pleistocene geologists agree in this point—complete deglaciation occurred on the northern hemisphere, probably resulting in a sea-level higher than now. This interglacial was much longer than the Riss/Würm, and already in 1929 Soergel was able to show that at least one cool oscillation occurred during this interglacial, a phase which he now links up with the Mindel glaciation, though he still calls it Pre-Riss. It matters little with which radiation minimum this phase has to be connected, but the marine deposits of the Great Interglacial should show corresponding oscillations of level as well as faunal evidence for an occasionally cooler climate (which, indeed, it does, as will be seen below). The high sea-level of the Great Interglacial must have persisted much longer than that of the Riss/Würm.

Preceding the Mindel glaciation with its subphases, another period of more or less complete deglaciation and therefore of a high sea-level has to be postulated. This period, in turn, was preceded by the phases of Günz, which, however, were not intense. One, therefore, may assume that they merely produced more or less considerable fluctuations of a generally high sea-level, and occasional changes in the marine fauna. The earliest stages of this high sea-level phase merge with the transitional Plio-Pleistocene beds.

The preceding lines contain a theoretical deduction of the probable fluctuations of sea-level, based on the theory of glacial control and on the curve of solar radiation. It is graphically treated in the accompanying sea-level curve (fig. 5), which was developed only from the observations on the relative extension of the ice-sheets, the values for which were transferred into units of ice-volume. It has to be emphasised that this curve does not include any evidence or observations concerning the heights of Mediterranean or any other sea-levels, though it has to be admitted that it agrees exceedingly well with the known facts. To readers who are little acquainted with the great amount of knowledge concerning the glacial phases that has been accumulated in continental Europe during the last two decades, and to whom the theory of Pleistocene climatic fluctuations originally established by Köppen and Milankovitch is not known, this deduction may seem to be somewhat speculative—which, however, it is not.

This is evidenced by the table (pp. 398–399) that summarises the above theoretical results and compares them with the fluctuations of sea-level which have been actually observed in the Mediterranean.

The three left columns of this table show the main divisions of the Pleistocene, their subphases as they are observed in districts where detailed stratigraphical sections are preserved (chiefly the periglacial area), and the age in years of the minima of summer radiation which initiated the cold phases. As an allowance for the effect of retardation, a deduction of at least 5000 years has to be made from each of these figures in order to arrive at a more accurate date for the maximum of the corresponding glacial phase (Zeuner, 1935). It would be a mistake if these figures were taken as too definite, though they cannot be far from the actual dates.

The fourth column summarises what was explained above, namely, the changes in the sea-level that one theoretically would expect to find, basing on the available evidence of the extension of the various ice-sheets and on the fluctuations of solar radiation.

The fifth column contains the proved fluctuations of sea-level in the Mediterranean. Our knowledge bearing on this matter has greatly increased since Dr. A. C. Blanc took up the study of the coastal plains of middle Italy some years ago, and it was of the greatest value to me that I recently had the opportunity of visiting most of the important sections under his personal guidance. His results * supplement Gignoux's earlier studies, particularly as to the later phases. The chief results of these two authors are as follows (Gignoux, 1913; A. C. Blanc, 1936, 1937 *b*):—

(1) Three cycles of marine transgressions and high levels have to be distinguished: Calabrian, Sicilian, and Tyrrhenian. These are the obvious equivalents of the three high-level phases postulated in the present paper

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* Botanical work by E. Tongiorgi, 1936, 1937.

Fluctuations of Sea-level and Climate in the Mediterranean Area.

Main glaciations and inter-glacials.	Sub-phases.	Corresponding minima of summer radiation (*unreduced*).	Theoretical sea-levels.		Observed Mediterranean sea-levels.	Fauna or flora in northern Mediterranean (sea or land)	Mammal fauna and climate of Palestine.
Postglacial.			Up to normal.		End of Flandrian transgression.	Mediterranean.	Drying up, steppespreading (Wad C, B).
Würm . . .	W_3	— 25,000	Generally low.	Less low.	Peats with cool flora.	Cool.	
	W_2/W_3			Temporary rise.	Marine layer with *Purpura* and *Vitis*.	Mild, *Vitis*-climate.	
	W_2	— 72,000		Low.	Temporary recession of water, peat formation in the Versilia	Cool, humid at first, then continental.	Slightly damper (Wad D).
	W_1/W_2			Temporary rise.	Marine layer at —70 ms. in the Versilia.	Mild, *Vitis*-climate.	Drier interval (Wad F, E).
	W_1	—115,000		Lowest.	Post-Tyrrhenian regression to —100 ms. approx.	Cool and humid.	Damp, forests prevailing (Tabun B).
Inter-glacial Riss/Würm.	PW	—145,000	High, with oscillations during transgression.		Tyrrhenian, possibly to be subdivided into Tyrrh. I and II.	Warmer than now.	(Wetter at close.) Increasingly drier, steppe spreading (Tabun E *b*–C).

Riss	**R$_2$**	**—187,500**	**Very low.**	**Coast-line low.**	**(? Cool-temperate.)**	**Damp, forests (Tabun E*c*, E*d*).**
	R$_1$	**—230,000**				
Inter-glacial Mindel/Riss or Great Inter-glacial.	**PR**	**—305,000**	**High, with oscillations during transgression.**	**Sicilian, with oscillations.**	**Warm, with cold invasions.**	
Mindel . .	**M$_2$**	**—435,000**	**Very low.**	**Coast-line low.**	**(? Cool-temperate.)**	
	M$_1$	**—476,000**				
Interglacial Günz/Mindel.			**High, with oscillations.**	**Calabrian.**	**Warm, with cold invasions.**	
Günz	**G$_2$**	**—550,000**				
	G$_1$	**—590,000**				
Pre-Günzian.		**Years before present.**				

on theoretical grounds. They are separated from each other by regressions and phases of a very low sea-level. According to Gignoux, the Calabrian seems to have developed continuously from the Pliocene, and the first great recession did not take place until after the Calabrian. The fauna of the Calabrian is characterised by the presence of certain boreal forms, such as *Cyprina islandica* (Gignoux, 1913, pp. 596–602), and this, as well as the continuity of the Upper Pliocene into the Calabrian, agrees well with the conditions expected for the pre-Mindelian Pleistocene: A high-level period with intercalations of cool phases (evidenced by cool elements in the fauna), which are the equivalent of the Günzian phases of the North. Short oscillations of the sea-level are probable for this period, but have not yet been properly studied.

(2) The Sicilian follows the Calabrian as an entirely independent cycle. Since the latest cycle, the Tyrrhenian, is doubtless the equivalent of the interglacial Riss/Würm, the Sicilian must correspond to the only remaining long period of recession, *i. e.*, the interglacial Mindel/Riss. The fauna of the Sicilian deposits, too, contains cold elements apart from the majority of ordinary Mediterranean forms (Gignoux, 1913, pp. 602–605). This observation, somewhat puzzling at a first glance, finds a reasonable explanation in the above-mentioned presence during this interglacial of one or more cool oscillations (such as Pre-Riss, for instance). Moreover, oscillations of the sea-level during the Sicilian are highly probable so that Blanc, in his paper on the relations between the Caspian, the Black Sea, and the Mediterranean, speaks of Sicilian transgressions and inter-Sicilian regressions. Thus, the Sicilian oscillations and the fauna of this period are in good accord with the present writer's deductions from the radiation curves.

(3) According to Blanc, the Tyrrhenian also can be subdivided into two phases separated by a slight regression. I do not know if this oscillation was caused or not by the cool phase Pre-Würm, though it is possible. The Tyrrhenian is characterised by a fauna which is distinctly warmer than that of the present Mediterranean. This is a very interesting feature, since it agrees completely

with findings made elsewhere and bearing on the climate of the interglacial Riss/Würm. This interglacial left traces of a climate with very warm and dry summers in the loess districts of North France and West Germany, where on the Older Loess the *argile rouge* was formed as a weathering soil under sub-Mediterranean conditions. Further evidence for warm summers during this time is provided, for instance, by the flora of the famous Mousterian site of Ehringsdorf near Weimar, Central Germany, where *Juglans regia* and other plants requiring hot summers were able to grow. All this is remarkably confirmed by the curves of summer radiation, which, for 65°, 55°, and 45° N. lat., have never since reached the amounts characterising the time between Pre-Würm and Würm 1 (compare tables in Milankovitch, 1930). Thus, climatic evidence strongly supports the correlation of the Tyrrhenian with the interglacial Riss/Würm, especially with its later part (Pre-Würm–Würm 1).

(4) Concerning post-Tyrrhenian times, A. C. Blanc writes (1937 *a*, translated from Italian): "Whilst the Tyrrhenian, with its strand-line higher than the present one and with its warm water inhabited by mollusks of Senegalese provenance, appears in all probability to be attributed to an interglacial, the post-Tyrrhenian regression and the Flandrian * transgression represent, according to the proposed interpretation, one three-fold glacial period. This period is characterised by a first cold phase of an essentially oceanic character, during which the maximum accumulation of glaciers would have been attained (maximum relative to this glacial period), and therefore the maximum value of the corresponding marine regression also (circa −100 ms.). A first temperate oscillation would have determined the beginning of the melting of the glaciers and therefore the beginning of the epiglacial marine transgression. A new cold phase intervened when the Flandrian strand-line had already attained the height of −50 ms. It indicates the maximum cold and a distinctly continental character of the climate. A strand-line of about −30 to −12 ms. corresponds to a second temperate oscillation. There follows a third

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* Unlike Dubois, Blanc includes in the term "Flandrian" the whole succession after the maximum regression. (Present author's note.)

moderately oceanic cold phase * which then passes into the temperate conditions of protohistoric times."

A comparison of this summary of Blanc's work in the Bassa Versilia and the Agro Pontino with the sea-level-curve (fig. 5) shows how well observations and theory agree. The three low-level phases of the Würmian are the equivalents of the three terrestrial or freshwater phases in Blanc's sequence, and his two marine ingressions correspond to the oscillations Würm 1/Würm 2 and Würm 2 /Würm 3. The latter had a mild climate, comparatively much milder than interstadials were in the North of Europe. This was due to the low latitude of these Italian districts. It is further characteristic that the first phase of Würm produced a *humid* and cool climate in Middle Italy, whilst the second had a more continental type of climate. It will be shown elsewhere † that these differences harmonise with the relative intensity and duration of the cold phases and that they are partly due to the glacials in the north and the pluvials in the Mediterranean not being entirely contemporary. The climatic fluctuations, however, are outside the main scope of this paper; it suffices to mention here that they are in excellent accord with the radiation curves for the respective degrees of latitude, not only in Italy, but as far as Palestine, which, for this reason, has been added to the table on pp. 398–399 on the evidence of Miss Bate's painstaking palæontological studies (Garrod and Bate, 1937).

The comparison, contained in the present paper, of the actual conditions observed in the Mediterranean, with those postulated on the basis of the "glacial control theory" and of the curves of solar radiation, shows

(1) why there are only three main cycles of marine transgression in the Mediterranean;

(2) that the observable climatic phases and changes of sea-level in the Mediterranean agree completely with

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* There is evidence in the Agro Pontino that this phase was connected with a drop of the sea-level. Near Sabaudia, the dune-sands containing Upper Palæolithic, are dissected by valleys which must have been cut during a low-level phase corresponding to Würm 3. They are now drowned and form a rias-coast-line. A strip of dunes has been built up in sub-Recent and Recent times, and now separates lagoon-like lakes with the rias-valleys from the open sea. See also map in Blanc, 1936, p. 139. (Present author's note.)

† Preliminary discussion in Zeuner (1938).

the fluctuations postulated on the basis of the curves of solar radiation.

Although I am fully aware of the great difficulties in the way of a general application of the radiation curves to Pleistocene stratigraphy, I cannot help seeing in this surprising agreement of the conditions in the Mediterranean with the changes in the radiation of the sun. another important justification of this chronological method. Moreover, it seems to me that, here, another way is being opened for research bearing on the general changes of sea-level over the earth, their connection with climatic fluctuations, and, ultimately, their approximate dating in years.

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EXPLANATION OF FIGS. 1–5.

Curves showing climatic and eustatic fluctuations during the Pleistocene. All curves on the same time-scale, counting in thousand years before 1800 A.D.

Fig. 1.—Curve demonstrating the duration of the interglacials according to A. Penck (1909). The lengths of the intervals are based on observations of weathering and deposition, and on an estimate for the length of the post-Würmian time of at least 20,000 years. Note the remarkable agreement of this curve with the astronomical curve, fig. 2.

Fig. 2.—Curve showing the fluctuations of solar radiation received by the earth from the Sun during the summer half of the year, for 65° North lat. Instead of the amount of radiation its equivalent is given in the form of an imaginary alteration of the geographical latitude. After Milankovitch (1930), who constructed this curve from the astronomical fluctuations of the inequalities of the earth's orbit.

Fig. 3.—Glaciation curve for the area between 11° and 19° East long., after Soergel (1937). It shows the fluctuations in the southward extension of the Scandinavian ice-sheet in the indicated sector, and is based, for the major phases on observed facts, and for the intervals between the major phases on deduction from the relative intensity of the periglacial climate. The intensity of the minor phases might, therefore, be exaggerated in some cases. The radiation curve (fig. 2) was used as a time-scale, with an allowance of about 5000 years for retardation. This amount is, probably, too small for glacial phases larger than Würm 3.

Fig. 4.—Curve showing the fluctuations of solar radiation received by the earth from the Sun during the summer half of the year, for 75° South lat. (Antarctica). The amount of radiation is given in canonic units which have a fixed relation to the solar constant. Note that the minima were nearly but not quite contemporary with those on the northern hemisphere, that they were more equal than those which caused the glaciations of the northern hemisphere, and that the minimum corresponding to northern Würm 1 was the strongest of all. Curve constructed from figures contained in Milankovitch (1930), table 15.

Fig. 5.—This curve shows the theoretical changes of sea-level for the Mediterranean (and also for the whole earth) under the assumption that the glacial phases of Europe and North America were contemporary. The possible influence of the Antarctic glaciation (never more than about 15 per cent. of the earth's total) is not accounted for, nor is the retardation of the North American ice-caps (which must have slowed down the transgressions after low-level phases). The curve is further inaccurate in the heights of the high-level phases, which schematically are assumed to have been the same (Sicilian and Calabrian levels were in reality higher than Tyrrhenian). The low-level oscillations are given in relative volumes of absorbed water, calculations having been based on our knowledge of the varying extension of the Scandinavian ice-cap. Time-scale and positions of the respective phases are derived from the radiation curve, and a retardation of about 5000 years has been applied to the minima throughout.

The curve thus shows the oscillations in the volume of water absorbed by the ice-caps and their approximate position in time. In spite of the many unavoidable simplifications it is of great value, since it shows how the sea-level would approximately have oscillated if the glacial control theory is true. It is important to note that

no evidence whatsoever concerning the observed heights of sea-level has been embodied in the curve.

Nevertheless, the curve, in fact, agrees excellently with the observations made in the Mediterranean. Some of the names of the Mediterranean phases have been inserted (the Flandrian defined as by A. C. Blanc). The part of the curve from the Tyrrhenian transgression to the present agrees in every detail with the known facts. Owing to its character as a volume-curve, the minima of the two strongest glaciations (Mindel and Riss) are very much greater than in the curve which shows the linear southward extension of the ice-sheets only (compare fig. 3). Riss 2 and Mindel 2 are assumed to have absorbed about the same volume of water.

It is particularly striking that during Mindel 2 and Riss 2 the sea-level would have dropped almost by twice the amount of Würm 1. A. C. Blanc claims 100 ms. for the lowering during Würm 1, so that about 200 ms. would result for the lowering during Riss as well as Mindel. This amount was already postulated by M. Boule on the evidence of the submarine shelf in the Mediterranean. If it is correct, it would mean that during the maximum glaciations about twice as much water was absorbed in the ice-caps than during the Würmian, and the estimates for the maximum glaciations made by Daly and others are too small.

A drop of 200 ms. would have allowed faunas of post-Günzian age (evolutionary level of Forest Bed, Upper Val d'Arno, but not higher than Mauer and Mosbach) to spread as far as Malta, and it is, for instance, possible that a form of *Elephas* closely related to *E. meridionalis* or earliest *E. antiquus* was able in Mindel times to reach Malta, where it developed into the dwarfed *E. falconeri* Busk. during the subsequent period of isolation.

LXIX.—Hispinen *aus dem Britischen Museum.*—II. Teil. 72. *Beitrag zu Kenntnis der Hispinen* (*Coleoptera*, Chrysomelidæ). Von Erich Uhmann, Stollberg-Erzgebirge.

Das Britische Museum übergab mir ein umfangreiches *Hispinen*-Material aus allen Teilen der Welt zur Bearbeitung. Die Ergebnisse meiner Studien habe ich in diesem Beitrag niedergelegt. Paratypen der neuen Arten und zahlreiches anderes Material wurden mir in zuvorkommendster Weise überlassen.

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65. Rev. Ent. Rio, 6, 1936, pp. 481–485.
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67. Entom. Blätter, 33, 1937, pp. 336, 337.
Uebersicht über die ersten Gattungen der *Uroplatini*.

Neue Gattung : *Phidodontina*.

Neue Arten :	1.	*Cephalolia chimboana*.	Ecuador.
	2.	—— *marshalli*.	Ecuador.
	3.	—— *apicenotata*.	Brasilien.
	4.	*Scelœnopla bahiana* (fig. 1).	Brasilien.
	5.	*Stethispa rudgeana* (fig. 2).	Brasilien.
	6.	*Uroplata denticulata* (fig. 3).	Brasilien.
	7.	*Octhispa spitzi*.	Brasilien.
	8.	*Leptispa rugifrons*.	Rhodesia.
	9.	*Phidodontina gedyei*.	Kenya.
	10.	*Gonophora bryanti*.	Borneo.
	11.	*Dactylispa marshalli*.	Borneo.

AMERIKA.

1. *Homalispa nevermanni* Uh. ab. (20, p. 212). Diese belanglose Aberration aus Ecuador unterscheidet sich von der Nominatform aus Costa-Rica nur durch die Färbung der Decken ; bei der Nominatform ist die knappe hintere Deckenhälfte schwarzblau, bei der Aberration dagegen drei Viertel. Unterseite nebst Beinen gefärbt wie bei der Nominatform.

♂ : Hinterrand des letzten Sternites ausgerandet.

♀ : Dieser Hinterrand abgerundet.

1 ♂, 2 ♀, Ecuador : Cachabé, low c., xi. 1896 (*Rosenberg*).

Das Vorkommen dieser mittelamerikanischen Art in Ecuador ist recht bemerkenswert und hat in der Verbreitung der *Amplipalpa marginata* Ws. aus Bolivia in Costa-Rica eine Parallele. Die *A. marginata* kommt nach einer brieflichen Mitteilung des Herrn Nevermann an Palmen im Urwald zusammen mit der *Cassidine Calyptocephala gerstäckeri* Boh. vor, der sie zum Verwechseln ähnlich ist.

2. *Demothispa clermonti* Pic ? Mel. ex-ent. 63, p. 2–, gehört in meinem Schlüssel 64, p. 203, neben *cayennensis* Pic. 1, Brasilien : Rio.

3. *Cephalolia daguana* Uh. 2 ♀, Columbia : Rio Dagua, 1 ♂, 1 ♀, Columbia : Buenava (*Rosenberg*).

3 *a*. Aberration. 1 ♂, 2 ♀, Ecuador : Cachabé, low c., i. 1897. Halsschild-Ränder schmal gelbbraun, auf den Decken ein keilförmiger Fleck und die Deckenspitze gelbbraun.

4. *Cephalolia applicata* Pic, Mel. ex-ent. 38, 1923, p. 9.

1 ♂, 1 ♀, Ecuador : Cachabé, low c., xi. 96 (*Rosenberg*).

♂ : Letztes Sternit in der Mitte ausgerandet. 1. Fühlerglied zur Spitze verdickt, 2. mit abgerundeter Ecke, 3. deutlich dreieckig erweitert, vorn schief abgeschnitten.

♀ : Letztes Sternit in der Mitte schwach vorgezogen, beiderseits schwach ausgerandet. 1. Fühlerglied schlanker, 3. Glied mit spitzer Vorderecke.

In meinem Schlüssel der *Cephalolia*-Arten in 65, p. 484 neben *nubila* Ws. zu stellen.

Aberrationen : Die schwarze Färbung dehnt sich längs der Naht aus, sodass die helle Querbinde in 2 längliche Flecke zerfällt. Vielleicht ist *applicata* nur eine Aberration von *nubila*, die dunkle Halsschild-Mittelbinde dieser Art fehlt *applicata*.

5. *Cephalolia nubila* Ws. 1, ♂, 1 ♀, Ecuador : Above Chimbo, 3000′, viii. 97 (*Rosenberg*). Geschlechter wie bei *applicata*. Weise's Holotypus (57, p. 110) stammt ebendaher.

6. *Cephalolia rosenbergi* Ws. Allotypus ♂. Die mir vorliegenden 3 Stück (2 ♂, 1 ♀) dürften aus derselben Ausbeute stammen, aus der Weise die Art beschrieb (Arch. Natg. 1905, 1, p. 55). Sie scheinen entweder einer hellen Aberration anzugehören oder sind unausgefärbt. Die von Weise angegebene schwarze Zeichnung auf den Decken fehlt und ist nur durch eine schwache, dunkle Bräunung ersetzt, die schwarze Mittelbinde des Halsschildes bei dem ♀ nur noch an der Basis, vorn nur ein schmaler Strich. Die von Weise erwähnten Längsfurchen auf dem Kopfe sind nicht vorhanden, wahrscheinlich sind sie bei dem einzigen Stück, dem Holotypus ♀, das Weise vorlag, nur individuell so gut ausgebildet. Stirn mit mattem Fleck neben dem Auge. Das bisher unbekannte ♂ hat dieselbe Fühlerbildung wie das ♀. Letztes Sternit an der Spitze seicht ausgerandet.

In meinem Schlüssel der *Cephalolia*-Arten (65. p. 484) kommt *rosenbergi* neben *nubila* zu stehen.

3, Ecuador: Above Chimbo, 3000′, viii. 1897 (*Rosenberg*).

Eine ganz ähnliche Art liegt mir noch in 2 ♀ aus Columbia: Bonaventura (*Rosenberg*) vor, bei der aber das 4. Fühlerglied einfach ist.

7. *Cephalolia chimboana*, sp. n. Subdepressa, nitidula, flavo-testacea, articulis ultimis antennarum infuscatis.—Prothorace transverso, subdepresso, sparse punctato, punctis evanescentibus, lateribus antice divergentibus, angulis anticis productis, late rotundatis; elytris tenuiter punctato-seriatis, punctis infuscatis, striis non sulcatis, interstitiis planis.—6·5 mm.

♂: Sternito ultimo valde emarginato.

♀: Sternito ultimo rotundato.

Von den einfarbig gelbbraunen *Cephalolia*-Arten durch die glatten Decken unterschieden, die nur sehr fein punktiert-gestreift sind und auf denen die Punktreihen nicht vertieft sind, sodass also Punktreihen und Zwischenräume gleich hoch liegen. Der rotbraunen *C. interstitialis* Ws., von der ich einen Paratypus habe, recht ähnlich, aber das 1. Fühlerglied nicht mit vorgezogener Aussenecke, sondern einfach und die Seiten des Halsschildes nicht parallel, sondern nach vorn divergent.—Hell gelbbraun, die 4 oder 5 letzten Fühlerglieder angedunkelt, Spitze des letzten hell, auf den Decken der Umkreis der Punkte dunkel.—Stirn glatt, äusserst fein erloschen punktiert, zwischen den Augen stumpf gekielt. Fühler von der Breitseite: Glied 1 gestreckt, 2 etwas kürzer, 3 so lang wie 1, 4 = 5, jedes so lang wie 3, 6–10 leicht quer, untereinander wenig verschieden, 11 länger als breit, an der Spitze abgerundet.—Halsschild quer, nach vorn verbreitert, mit breit abgerundeten und vorgezogenen Vorderecken, mit leistenartigem Seitenrand, flach gewölbt, mit sehr zerstreuten, sehr flachen Punkten, ohne doppelte Punktierung.—Schildchen verrundet-fünfeckig.—Decken parallel, an der Spitze gemeinsam abgerundet, Seitenrand fein gerandet, kaum abgesetzt, Schultern nur sehr wenig hervortretend, die sehr feinen Punktreihen mit den dunkel umrahmten Punkten bis zur Spitze deutlich, Zwischenräume unpunktiert, bei *interstitialis* fein punktiert.

♂: Letztes Sternit tief und breit ausgerandet. ♀: Dieses abgerundet.

1 ♂, 2 ♀, Ecuador: Chimbo (*Rosenberg*). 1 ♂, Ecuador: Cachabé, low c., xii. 96 (*id.*). Holotypus ♂, Allotypus; ♀, beide vom Chimbo.

8. *Cephalolia unctula* Pic (Mel. ex-ent. 1923, 38, p. 8). 3 ♂, 1 ♀, Ecuador: Cachabé, low c., 1896 (*Rosenberg*).

♂: Letztes Sternit tief ausgeschnitten 4·5 mm. ♀: Dieses schwach doppelbuchtig, 5 mm. Nach einem von Weise benannten Stück der coll. Kraatz im Deutschen Entomologischen Institut Berlin-Dahlem aus Columbia; neben *affinis* Baly und *interstitialis* Ws. wegen des vorn nach aussen erweiterten 1. Fühlergliedes zu stellen.

9. *Cephalolia marshalli*, sp. n. Oblonga, nitida, flava, vertice medio, vitta mediana prothoracis, scuto, macula ovali scutellari in tertio basali elytrorum nigris, antennis flavo-testaceis, subtus lateribus sterni nigris.—Fronte impunctata; prothorace sparse et irregulariter punctato, transverso, rectangulari, angulis anticis rotundatis, prominentibus; elytris regulariter et tenuiter punctato-striatis, punctis infuscatis, striis non sulcatis, interstitiis planis. 6·5 mm.

♂: Sternito ultimo emarginato; ♀: illo rotundato.

Der *C. æquilata* Uh. (20, p. 223, fig. 1) durch parallelseitige Gestalt ähnlich, aber grösser und schmäler.—Glänzend, gelb, Fühler gelbbraun, schwarz: Eine nach hinten sich verbreiternde Längsbinde, die auf dem Scheitel beginnt, die Mitte des Halsschildes durchläuft und auf Schildchen nebst Decken einen ovalen Fleck im Basaldrittel bildet; unter der Schulter eine geringfügige Trübung; Seiten der Vorder-, Mittel- und Hinterbrust, diese beiderseitige Längsbinde setzt sich auf den Sterniten als Trübung fort.—Stirn gleichförmig-gewölbt, äusserst fein punktiert, mit einer Schwiele zwischen den Fühlern. Fühler den Hinterrand der Decken etwas überragend, gleichbreit, vom 3. Glied dicht behaart, 1. Glied am längsten, die übrigen zylindrisch, voneinander wenig verschieden.—Halsschild 1½ mal so breit wie lang. Seiten parallel. Vorderecken vorgezogen-abgerundet. Scheibe bis kurz vor den etwas aufgebogenen Seitenrand gewölbt, ziemlich stark und unregelmässig zerstreut punktiert.—Schildchen lang 5-eckig, glatt.—Decken wenig breiter als der Halsschild, mit feinen, regelmässigen Punktreihen, ohne vertiefte Streifen, Zwischenräume nicht gewölbt. Jeder Punkt in einem dunklen Fleck. Seitenrand schmal abgesetzt, Spitzenrand gemeinsam abgerundet.—Seitenstücke der Mittel- und Hinterbrust punktiert.

♂: Letztes Sternit ausgerandet, ♀: dieses einfach abgerundet.

1 ♂, Ecuador: Cachabé low c., xi. 1896 (*Rosenberg*) Holotypus. 2 ♀, ebendaher, Allo- und Paratypus.

10. *Cephalolia pretiosa* Baly. 3 ♂, 1 ♀, Ecuador (*Rosenberg*): 1 Above Chimbo, viii. 1897, 3000′; 3 Cachabé, low c.

Bei 3 Stück ist der flach abgesetzte Seitenrand des Halsschildes nach hinten stark verschmälert, sodass er vor den Hinterecken schliesslich nur noch fein gerandet ist, sonst sind keine Unterschiede zu sehen.

11. *Cephalolia dilectans* Pic. 3 ♀, Ecuador: Cachabé, low c., xii. 1896, i. 1897 (*Rosenberg*). Fühler einfach. Hat nichts mit *applicata* Pic zu tun. ♀: Letztes Sternit in der Mitte schwach vorgezogen, beiderseits schwach ausgerandet.

In der Deckenzeichnung der *C. reventazonica* Uh. (20, p. 226) aus Costa-Rica ähnlich, aber Fühler und Halsschild ganz gelbbraun, Halsschild breiter, nicht glatt, sondern ziemlich dicht punktiert mit Ausnahme eines Mittelstreifens, Seiten ziemlich breit abgesetzt, Vorderecken abgeschrägt gerundet vorgezogen. Decken etwas oval, nicht parallel, Seitenrand schmal abgesetzt.—Verglichen mit einem von Weise benannten Stück aus coll. Kraatz im Deutschen Entomologischen Institut, Berlin-Dahlem.

12. *Cephalolia recondita* Pic. 1 ♂, 2 ♀, Ecuador: Above Chimbo, 3000′, viii. 1897 (*Rosenberg*), 1 ♂: Columbia: Buenaventura (*id.*). Nach einem von Weise benannten Stück des Deutschen Entomologischen Instituts.

13. *Cephalolia insidiosa* Pic 4 ♂: 3, Ecuador: Paramba 3500′, 1897, dry season (*Rosenberg*); 1, Ecuador: Cachabé, low c., xi. 1896 (*id.*).– ♂: Hinterrand des letzten Sternites abgestutzt, nur schwach ausgerandet. Verglichen mit einem von Weise benannten Stück des obigen Instituts.

13 *a*. Aberration? 1 ♀: Ecuador: Chimbo (*Rosenberg*). Hinterrand des letzten Sternites abgerundet. Fühler ganz gelbbraun, die schwarze Deckenzeichnung fast geschwunden, sie besteht aus 2 sehr kleinen Flecken beiderseits des braunen Schildchens, die Querbinde hinter der Mitte deutlicher, braun Ob eigne Art?

Insidiosa Pic ist nahe mit *trimaculata* Baly verwandt, aber kleiner, die einfarbig schwarzen Fühler dünner. Nicht verwandt mit *humeralis* Ws. wie *Pic* schreibt (Mel. ex-ent. 38, 1923, p. 9).

14. *Cephalolia apicenotata*, sp. n. Nitida, flavo-testacea, antennis, macula semicirculari communi in apice elytrorum, sternito ultimo nigris.—Fronte tenuissime punctulata; antennis gracilibus; prothorace transverso, irregulariter et sparse punctato, lateribus S-formantibus, antice leviter ampliato; elytris regulariter punctato-seriatis, striis interioribus tenuibus, interstitiis exterioribus leviter convexis.—6·5 mm.

♀: Sternito ultimo truncato-rotundato, utrinque leviter emarginato.

Gelbbraun, einer *vittipennis* Ws. ähnlich, bei der die schwarze Deckenzeichnung nur noch im Spitzendrittel vorhanden ist. Bei 3 Stück der neuen Art zeigen die gelbbraunen Decken noch eine etwas hellere Zeichnung, die der Zeichnung der *vittipennis* entspricht. Sie besteht aus zwei nach hinten konvergierenden Längsbinden und dem helleren Seitenrand. Würde das dunklere Gelbbraun schwarz werden, dann hätten wir die Deckenzeichnung der *vittipennis* vor uns. Der Deckenfleck bedeckt den Hinterrand, lässt den Seitenrand frei und zieht sich auf dem 6. und 9. Zwischenraum nach vorn. Schwarz sind noch die Fühler und das Endsternit. Skulpturelle Unterschiede gegen *vittipennis* : 1. Stirn leicht konkav und nicht fast eben ; 2. Halsschildseiten S-förmig geschwungen, Halsschild vorn etwas breiter und nicht fast gerade und nicht parallel ; 3. Wangen und Vorderbrust unpunktiert und nicht dicht punktiert.—Stirn mit sehr feinen Pünktchen. Fühler schlank, gleich breit. Glied 3–10 zylindrisch, dicht behaart, 3 das längste, so lang wie 1. 11 von der Schmalseite stark zugespitzt. Halsschild stark, unregelmässig zerstreut-punktiert, Seiten deutlich abgesetzt, Vorderecken fast verrundet.—Schildchen 5-eckig.—Decken an der Spitze fast einzeln gerundet-abgestutzt, innere Punktreihen fein, äussere Zwischenräume schwach erhaben, Seitenrand ziemlich breit abgesetz, fast so breit wie ein Fühler.

♀ : Letztes Sternit abgerundet, beiderseits schwach ausgerandet. 5 ♀, Brasilien : Bahia (coll. Fry).

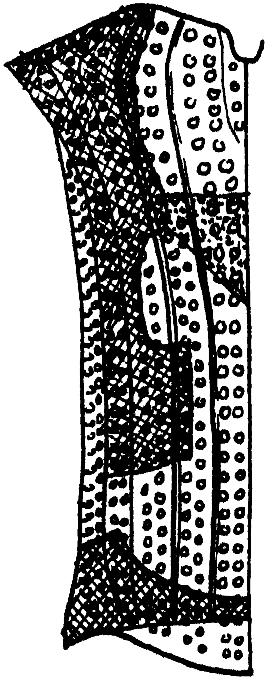
15. *Scelænopla* (s.str.) *bahiana*, sp.n. (Fig. 1.) Subnitida, flavo-testacea, articulis 8–11 antennarum obscurioribus, elytris maculis violaceis : (1) macula quadrata humerali, (2) post eam macula quadrata mediana, foris linea tenui cum macula humerali cohaerente, (3) fascia subapicali interdum cum macula mediana cohaerente vel in sutura interrupta.—Antennis gracilibus ; prothorace subquadrato, lateribus fortiter bisinuatis, modice punctato antice medioque lævi ; elytris subparallelis, humeris in dentem acutum et angulo postico in laminam acutam brevem productis, disco regulariter punctato-striato, costis quattuor modicis quarta tenuissima.—6 mm.

♂ : Tibiis anticis dente acuto subapicali.

Gehört mit *Sc. sheppardi*, *octopunctato*, *pulcherrima* und *fryella* Baly in eine Gruppe. Bei diesen Arten ist die Schulter in einen starken Zahn erweitert.—Hell gelbbraun, Halsschild etwas dunkler gelbbraun, Fühlerglieder 8–11 angedunkelt, Decken mit etwas veränderlicher blaumetallischer Zeichnung (siehe Abbildung) : 1. Mit einer

Längsbinde von der Basis bis zu drei Viertel der Scheibe auf der 3. 9. Punktreihe, sie bedeckt also den Schulterzahn, im 2. Viertel wird die Binde von innen durch eine Einbuchtung, die mit der Grundfärbung zusammenhängt, fast unterbrochen, die 7. und 8. Reihe bleiben blau;

Fig. 1.



▨ normale Färbung

⁘ zusätzlicher Fleck.

Scelænopla bahiana, sp. n.

(2) mit einer Spitzenbinde, die von Aussenecke zu Aussenecke reicht und die Deckenspitze frei lässt, bei einigen Stücken ist sie an der Naht kurz unterbrochen. Diese Hauptfärbung ändert ab: (1) in mehreren Fällen durch Verschmälerung der Längsbinde von innen her um eine Punktreihe und in einem Falle durch ihre Verbreiterung nach innen bis auf die 2. Reihe, sodass die

helle Einbuchtung zu einem abgetrennten Fleck wird; (2) durch Erscheinen eines metallischen Fleckes im Basalviertel auf der Naht vor der hellen Einbuchtung, dann sind dort die beiden Längsbinden miteinander verbunden, und im extremsten Falle ist die Einbuchtung zu einem umschlossenen Fleck geworden. Diese Abänderung ist in 2 Fällen vollständig, in 3 anderen mehr oder weniger angedeutet.

Kopf glatt, mit flachem Eindruck, zwischen den Fühlern in eine scharfe Spitze ausgezogen. Kopfschild glatt, gewölbt. Fühler schlank, vom 7. Glied ab ein wenig stärker, Glied 8–10 gleichbreit, pubeszent, 11 zugespitzt. Glied 1 ellipsoidisch, 2 dünner, 1½ mal so lang, 3=4=5, jedes länger als 2, 6=2, 7 von der Basis zur Spitze etwas verbreitert, die nächsten dann in gleicher Breite anschliessend.—Halsschild etwas quer, stark gewölbt, mit in der Mitte stark gerundeten Seiten, Vorderecken stark vortretend, mässig dicht stark punktiert, vorn auf einer dreieckigen Fläche glatt, die sich auch auf die Mittellinie erstreckt, ohne die Basis zu erreichen.—Schildchen verrundet-rechteckig, glatt.—Decken parallel, nach hinten nur wenig breiter, am Hinterrand gemeinsam abgerundet, Hinterecken in einen flachen, kurzen, spitzen, nach hinten gerichteten Zahn erweitert. Schultern spitz, stark dreieckig nach aussen vorragend, vorn mit zwei tiefen Punkten. Scheibe mit 10 regelmässigen Punktreihen und 4 schwachen Rippen, die 4. in der Mitte weit unterbrochen. Deckenränder glatt, schwach abgesetzt.—Klauenglied unbewehrt.

♂: Vorderschienen vor der Spitze mit dreieckigem Zahn. Mittelschienen schwach gekrümmt, mit spitzem Endzähnchen nach innen.

♀: Vorderschienen an der Spitze dichter behaart, ganz wenig verbreitert. Mittelschienen wie beim ♂.

Holotypus ♂, Allotypus ♀ und 12 Paratypen.

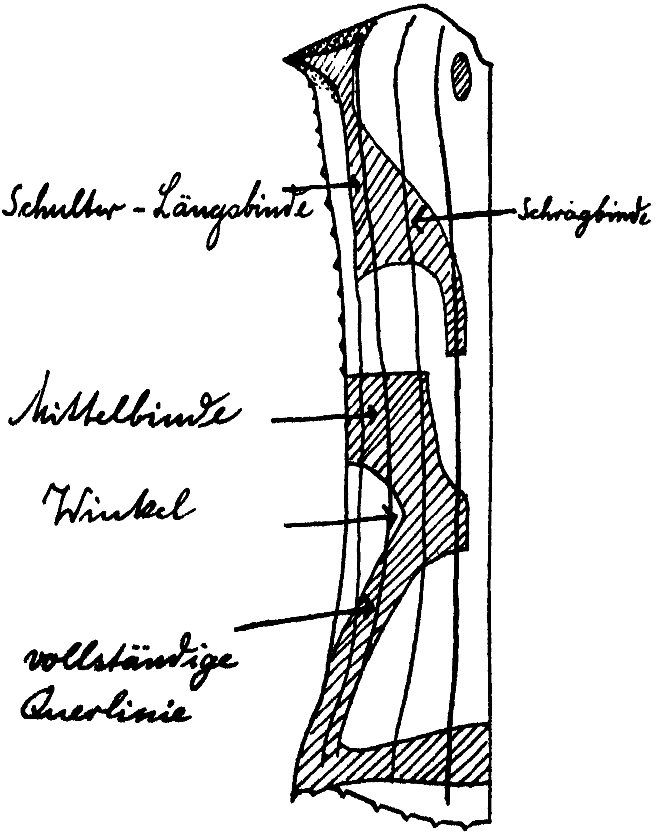
4 ♂, 6 ♀, Brasilien: Bahia (*Dr. Bondar*, 2049), ausserdem 2 ♂, 2 ♀ in meiner Sammlung.

16. *Scelænopla carinata* F. 3, Brasilien: Bahia (*Dr. Bondar*).

17. *Scelænopla pretiosa* Baly. 1 ♂, 3 ♀, Brasilien: Bahia (*Dr. Bondar*, 2039), an epiphytischen *Araceen*.

18. *Stethispa rudgeana*, sp. n. (Fig. 2.) *St. crenatulæ* Uh. similis, differt: statura majore, lateribus prothoracis magis angulatis, dente postico elytrorum minus prominenti, linea submarginali elytrorum medio interrupta, tibiis anticis posticisque apice incrassatis, dente parvo munitis. 7·5–8·5 mm.

Fig. 2.



Stethispa rudgeana, sp. n.

Der *Stethispa crenatula*, sp. n., inedita aus Paraguay recht ähnlich, die grünmetallische, purpurgesäumte Zeichnung stärker, die von der Schulter schräg nach innen laufende Binde bis *auf* die 1. Rippe ausgedehnt, die seitliche Schulter-Längsbinde von der Schulter- zur Mittelbinde vor letzterer unterbrochen, die Mittelbinde mit der Zeichnung auf der Hinterecke durch eine *vollständige* Querlinie verbunden, bei *crenatula* ist diese Querlinie vorm Ende der Mittelbinde unterbrochen ; der entstandene Winkel ist annähernd ein Rechter. Beine rötlich-gelbbraun wie die Fühler, Basis der Schenkel hell gelbbraun.—Fühler nur *wenig* zur Spitze verdickt, *kräftiger*, 7-10 *länger*, jedes dieser Gleider zylindrisch, länger als breit, von der Breitseite fast quadratisch, 7 am längsten, dieses so lang oder länger als 3.—Halsschild *breiter*, an der Basis mindestens *doppelt so breit wie lang*, Seiten in der Basalhälfte parallel, in der Mitte *stark* gewinkelt, zur Spitze *stark* konvergent, das Uebrige wie bei *crenatula*. Decken wie bei *crenatula*, Unterschiede : Mit Skutellarreihe ; 3. und 4. Rippe vorm Zahn der Hinterecke einander genähert. Zwischenstreif dort nur mit *einer* Reihe ; Zahn der Hinterecke kürzer, etwas mehr nach hinten gerichtet. —Beinbildung von *crenatula* abweichend : Vorderschienen an der Spitze verdickt, dort mit kurzem, spitzem Zahn, Innenseite der Schienen krenuliert und behaart, Mittelschienen gekrümmt, sonst wie die Vorderschienen. Hinterschienen innen krenuliert und behaart, gerade. Klauenglied einfach.—An *Rudgea*.

5, Brasilien : Bahia (*Dr. Bondar*, 2067). Holotypus und 2 Paratypen in meiner Sammlung, 2 Paratypen in der des Imperial Institut.

19. *Xenochalepus contubernalis* Baly. Was ich aus Costa-Rica bisher als *X. chapuisi* Baly (48, p. 273) bestimmt hatte, gehört zu obiger Art, wie Herr Prof. Maulik durch Typenvergleich festgestellt hat.

20. *Corynispa clavicornis* Uh. (21, p. 164 und 67, p. 337). 3, Brasilien : Bahia (*Dr. Bondar*, 2038). Auf Blättern einer Malpighiacee. Anscheinend unausgefärbt, das Rotbraun ist hell gelbbraun.

21. *Uroplata* (*Codiohispa*) *girardi* Pic (compacta Spaeth). Eine sehr veränderliche Art sowohl in der Färbung als auch in der Ausbildung der Hinterecken der Decken :

(1) Die Färbung vergleiche Spaeth, Ann. Nath. Mus. Wien, 48, 1937, p. 157. Konstant bleibt die helle, gelbe Zeichnung auf Halsschild und Decken. Die dunklere

Zeichnung auf dem Halsschild ist "mehr oder minder erzgrün oder blau metallisch schimmernd, zuweilen aber auch nur weniger dunkler braun als die übrige Scheibe; die Flügeldecken haben die gleiche metallische oder dunklere braune Färbung." Die Färbung schwankt also zwischen Metallglanz und Dunkelbraun. Diese Erscheinung findet sich auch bein verwandten Arten: *serrulata* Ws. und ab. *serratipennis* Sp.

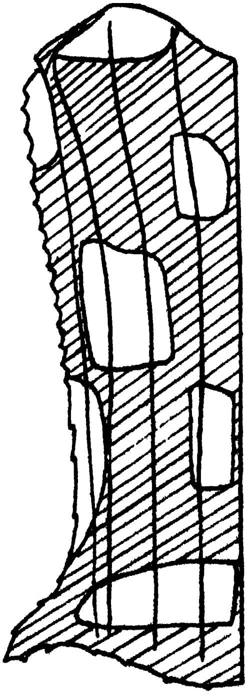
(2) Die Hinterecken (Aussenecken) erweitern sich "zu einer abgerundeten, nur mässig nach aussen vortretenden Ecke." Hier zeigt das mir vorliegende Material eine beträchtliche Schwankung. (*a*) Eine Zunahme in der Grösse und Ausdehnung nach aussen zeigen meine Stücke aus Bolivia: Coroico, wovon Spaeth aus derselben Ausbeute 2 Stücke besitzt und erwähnt (*l. c.* p. 156), ohne sich aber über die Bildung ihrer Hinterecken auszusprechen. (*b*) Eine Abnahme oder völligen Schwund haben Stücke aus Brasilien: Bahia (*Dr. Bondar*, 1628). Es liegen mir 10 Stück davon vor, 2 haben dieselbe Hinterecke wie ein Typus von *compacta*, bei 6 stossen Seiten und Hinterrand ohne Erweiterung nach aussen mit abgerundeter Ecke aneinander, von 2 nebeneinander geklebten, kaum 3 mm. grossen Stücken meiner Sammlung, hat eins ziemlich scharfe, das andere verrundete Hinterecken.

Ausser der verschiedenen Ausbildung der Hinterecken sind sonst keine Merkmale festzustellen, die eine artliche Verschiedenheit bedingten. Wir müssen also zu der Ueberzeugung kommen, dass *girardi* eine Art ist, die Ausbildung zu Rassen zeigt. Dr. Bondar beobachtete die Art an *Lantana camara*.

22. *Uroplata* (*Codiohispa*) *denticulata*, sp. n. (Fig. 3.) Flavo-testacea, subnitidula, apice tibiarum tarsisque subinfuscatis, vittis duabus prothoracis viridiaeribus; elytris viridiaeribus maculis flavo-testaceis: basali, subhumerali, duabus in costa prima, una communi in costis secunda et tertia ante medium, marginali ante dentem posticum, vitta transversali anteapicali.—Prothorace transverso, dense punctato, lateribus antice convergentibus; elytris quadricostatis, costa tertia tenui, non interrupta, angulo postico im laminam trigonam acutam lateraliter productis: femoribus anticis dente parvo, tenui, tibiis mediis valde curvatis.—5·25–5·5 mm.

Diese neue Art hat viel Aehnlichkeit mit *U. coarctata* Ws. sowohl in der Zeichnung als auch in der Bildung der Vorder- und Mittelschienen, die 3. und 4. Rippe vereinigen sich aber nicht, sie konvergieren aber zur Spitze ; Vorderschenkel mit kleinem, feinem Zahn wie bei *U. armata* Baly und *strandi* Uh. In meiner Uebersicht über die mir bekannten *Uroplata*-Arten (noch im Druck) stelle ich sie unter 1 *a* neben *coarctata* Ws., obwohl die 3. und 4. Rippe hinten nicht vereinigt sind, es ist aber ein Haftzahn da, der allerdings nur klein ist. Kopfschild im Profil beulig. Die Vereinigung der 3. und 4. Rippe ist eben ein zuweilen versagendes Merkmal.

Fig. 3.



Uroplata denticulata, sp. n.

Stirn unpunktiert, fein schagriniert. Fühler den Hinterrand des Halsschildes etwas überragend. Glied 1–5 wenig voneinander verschieden, 6 zuweilen kurz und fast quer, 7+8 halb so lang wie der ganze Fühler, 7 halb so lang wie 8.—Halsschild quer, doppelt so breit wie lang, dicht und grob punktiert, vorm Abfall zum Schildchen mit einer quer eingedrückten Linie. Vorderecken stark vorspringend. Seiten in der Basalhälfte fast parallel, dann zu den Vorderecken stark konvergent, in der Mitte gerundet. Die beiden grünen Längsbinden nicht weit von der Mitte entfernt, nach vorn konvergent.—Schildchen quer.—Decken in den Schultern breit, dann verengt, aber nicht so stark wie bei *coarctata*. Hinterecke vorspringend, spitz, Hinterrand. konvex, Nahtecke etwas weiter hinter der Hinterecke liegend; mit 4 Rippen, 3. und 4. fein, die 3. nicht unterbrochen, aber von der Mitte ab niedergedrückt. Alle Zwischenstreifen mit regelmässigen Doppel-Punktreihen, die beiden Reihen des 4. Streifens etwas zusammengerückt. Grünmetallisch, mit folgender, unscharf begrenzter, gelbbrauner Zeichnung: 1 Fleck auf dem Basallappen, 1 Randfleck unter der Schulter, 1 Fleck hinter dem Schildchen auf der 1. Rippe bis fast zur Naht, 1 Fleck von der 2. bis zur 3. Rippe in der Deckenmitte, 1 Fleck auf der 1. Rippe hinter ihm, 1 halbkreisförmiger Randfleck, der in der letzten Deckenhälfte bis vor den Deckenzahn liegt, 1 Querbinde von Zahn zu Zahn an der Naht schwach unterbrochen. Seiten- und Hinterrand gezähnelt, ebenso der Hinterrand des Deckenzahnes.—Unterseite der Vorderschenkel mit kleinem, spitzem Zahn an der Stelle, wo ihn auch die *Probænia*-Arten haben. Vorderschienen in der Innenmitte schwach gebogen, von dort zur Spitze verbreitert, innen sehr fein krenuliert und dicht behaart. Mittelschienen sehr stark gebogen, innen krenuliert und dicht behaart, an der Spitze mit feinem, spitzem Zähnchen, Hinterschienen innen dicht behaart. Alle Schenkelspitzen unten mit einzelnen Körnchen. Haftzahn klein.

Brasilien: Bahia (*Dr. Bondar*, 2051), an Leguminosen.

Holotypus und 1 Paratypus in meiner Sammlung, 4 Paratypen in der Sammlung des Imperial Institut of Entomology in London.

23. ***Octhispa spitzi***, sp. n. Rufo-testacea; prothorace vittis duabus nigris; elytris signaturis viridicyaneis purpureo-cinctis, maculis rufo-testaceis: 1 scutellari,

1 humerali in basi humeri. 1 posthumerali obliqua, 1 postmediana transversa, 1 apicali.—Humeris parum elevatis, costa secunda in basi, tertia in apice modice cristatis.—6 mm.

Gehört in eine neue, besondere Abteilung der *Octhispa*-Arten, bei denen die Schultern leicht erhöht und die hintere Aussenecke der Decken *nicht* erweitert ist.—Der *O. gemmata* Germ. ab *plagipennis* Chap. in Färbung und Deckenzeichnung ziemlich ähnlich, durch erhabene Schultern und hinter diesen bis zum Aussenwinkel etwas eingezogene Decken verschieden.

Gelbbraun, Fühler an der Basis etwas angedunkelt, Halsschild auf der Scheibe mit 2 dunklen, schwarzen Langsbinden, Decken metallisch-grün mit gelbbraunen, teilweise purpurgerandeten Flecken: einem Schildchenfleck; einem, der die ansteigende Schulter vorn bedeckt; einem Schrägfleck hinter der Schulter, der unter ihr beginnt undinnen bis zur 1. Punktreihe reicht, an der 3. Rippe ist er fast unterbrochen; einer Querbinde hinter der Mitte, die von einem Seitenrand zum andern reicht und an der Naht durch etwas dunklere Färbung kaum unterbrochen ist; einem gemeinsamen Spitzenfleck.—Kopf auf der Stirn glatt, ohne Punkte, Kopfschild stark vorspringend Vorderrand der Stirn vor die Augen vorgezogen. Fühler kräftig, Glied 7 und 8 verdickt, von der Breitseite: Glied 1 rundlich, 2 ebenso, aber schmäler, 3 so lang wie 2, konisch, 4–6 untereinander fast gleich, leicht quer.—Halsschild quer, mit fast parallelen Seiten, die von der Mitte nach vorn konvergieren, mit rechtwinkligen Vorderecken, auf der Scheibe unregelmässig stark punktiert, mit glatter Mittellinie.—Decken mit 3 starken Rippen, die 2. vorn stark, die 3. schwächer erhaben, sodass auf der Schulterbasis vorn eine glatte Schulterfläche entsteht, die 3. Rippe an ihrem Ende etwas stärker erhaben, Zwischenstreifen mit regelmässigen Doppelpunktreihen, an der Spitze gemeinsam abgerundet, Spitzenrand schwach konvex. Seitenrand schwach gezähnt, Spitzenrand mit einigen kleinen Zähnchen.—Klauenglied ohne Haftzahn.

2, Brasilien: Bahia (*Dr. G. Bondar*, 2089), Holo- und Paratypus. 1, Brasilien: Mar de Hespanha, E. Minas, 2. xii. 1908 (*J. F. Zikan* S) Bei diesem Paratypus sind die Binden des Halsschildes nur schwach angedeutet, die metallgrüne Zeichnung ist rotbraun. Dieses unausgefärbte Stück gleicht ganz der ab. *plagipennis* Chap. In meiner Sammlung.

Diese schöne Art widme ich dem Lepidopterologen, Herrn Spitz in Sao Paulo, der auch manche seltene *Hispinen*-Art aus Minas Geraes mitgebracht hat.

AFRIKA.

Von den zahlreichen Arten der Sendung bringe ich hier nur die Arten, deren Verbreitung von besonderem Interesse ist.

24. *Leptispa rugifrons*, sp. n. Angusta, parallela, nitidula, atra; fronte inter oculos rotundo producta, dense punctata; antennis sub fronte producta articulo primo simplici; prothorace subquadrato, inaequaliter punctato, lateribus sinuatis, angulis posticis subrectangularibus; elytris in apice deplanatis, truncatis, punctato-striatis, interstitiis postice elevatis.— Long. 4·5, lat. 4·1 mm.

Steht der *L. cornuta* Uh. (45, p. 434) am nächsten, unterscheidet sich aber von den mir bekannten Arten durch den paraboloidisch vorspringenden Kopf; die Fühler, die bei dieser Gattung mehr oder weniger auf die Unterseite des Kopfes rücken, sind bei *rugifrons* weit unter dem Vorderrand der Stirn eingelenkt. Stirn dicht, vorn fast runzlig punktiert. Hals mit feinen, weniger dichten Punkten. Augen flach.—Fühler höchstens die Halsschildmitte erreichend, zur Spitze schwach verdickt, Glied 1 stark, einfach, 2 kürzer und schmäler, 3 = 2, 4 kürzer als 3, von der Breitseite: 4 bis 8 einander ähnlich, zunehmend breiter, 9 und 10 länger und breiter, 11 eiförmig.—Halsschild fast so lang wie breit, Seiten fast parallel, bei 2 Stück mehr nach vorn, bei einem mehr nach hinten und an den Vorderwinkeln stark konvergierend. Hinterwinkel scharf, Vorderecken nicht vortretend. Scheibe ungleich und nicht dicht punktiert, Vorderrand und Mittellinie punktfrei.—Decken dreimal so lang wie der Halsschild, parallel, sur Spitze leicht verschmälert, hinten abgestutzt, mit sehr kleinem Nahtzähnchen, Seiten an der Spitze verflacht. Zwischenräume der Punktreihen vorn flach, Raum 8 ganz, die übrigen hinten deutlich konvex. Skutellarreihe lang, fein, im ersten Deckenviertel. Reihe 1, 2, 9 und 10 erreichen die Deckenspitze, 3, 4 und 8 enden kurz vorher, 5 und 7 noch etwas eher, 6 endet vor der Vereinigung von 5 und 7. Punkte der Reihen regelmässig verteilt, jeder Raum mit einer äusserst feinen Pünktchenreihe.—Jede Klaue mit kleinem Basalzahn.—Körper schwarz.

3, N.W. Rhodesia : 1, Mumbwa, x. 1914 (*H. C. Dolman*), Holotypus. Mwengwa, 27° 40′ E. 13° S. ; 10. vii. und 4. viii. 1914 (*id.*), Paratypen.

25. *Leptispa collarti* Uh. 1, Mashonaland : Salisbury (*G. A. K. Marshall*).

26. *Leptispa clavareaui* Ws. ab. *ruficollis* Uh. 1, Uganda : Kampala. 3780 ft. (*Gedye*).

27. *Leptispa frontalis* Ws. 1, N.W. Rhodesia : Mumbwa (*H. C. Dollman*).

28. *Oncocephala montivaga* Gest. 4, Nord-Rhodesia : Mqoa (*Dr. Lloyd*). 1, N.-Kavirondo (*Bussey*).

29. *Oncocephala proxima* Gest. 1, Uganda : Entebbe (*C. C. Gowdey*) und 1, Uganda : Bubulu (*Hopkins*). 2, Ost-Afrika : Kisumu (*Turner*).

30. *Oncocephala senegalensis* Guér. 1, Fernando Poo : Botonos (*W. H. T. Tams*).

31. *Oncocephala kolbei* Gest. 3, Brit. Ost-Afr. : Nairobi.

32. *Oncocephala gestroi* Ws. 1, W.-Darfur : S. Jebel Murra, Kallikitting, 4450 ft., 7. vi. 1932 (*M. Steele*).

PHIDODONTINA, gen. n. Steht *Pseudispella* Kr. am nächsten, da wie bei dieser die Klauen verwachsen und nur an der äussersten Spitze kurz gespalten sind, aber nicht divergieren, und das 1. Fühler-Glied oben in einen Dorn ausgezogen ist ; sie unterscheidet sich aber von ihr durch die an die Seite gerückten Vorderrand-Dornen des Halsschildes, die enge Verschmelzung der Endglieder der kürzeren und dickeren Fühler. Von den beiden anderen in Afrika vertretenen Gattungen, bei denen die Vorderdornen an die Seite geschoben sind, *Pleurispa* Ws. und *Phidodonta* Ws., hat die erstere die Klauen in einen gemeinsamen, dornförmigen Zahn umgebildet, während bei *Phidodonta* die Klauen ganz getrennt und gespreizt sind.

33. *Phidodontina gedyei*, sp. n. Körper sehr schmal und lang, mit parallelen Seiten. Schwarz, Decken blaumetallisch, schwach glänzend, übrige Oberseite matt.—Fühler nicht länger als Kopf und Halsschild zusammen, ziemlich dick, 1. Glied gegen das Ende stark verdickt, kaum länger als dort breit, Spitze unten abgestutzt, oben mit einem Dorn, der fast bis zum Ende des 3. Gliedes reicht, also viel länger ist als bei *Phidodonta*, folgende Basalglieder mit tiefen Längsrinnen, 2. kuglig, kaum so lang als dick, mit dünnerer Basis, 3. um mehr als die Hälfte länger, an der Basis dünner als am Ende, 4. nicht länger als das 2., die folgenden zwei werden kürzer, alle mit einzelnen weissen Härchen, Endglieder viel dichter weissgrau behaart und so eng aneinandergefügt, dass ihre Trennungsnähte nur schwer zu erkennen sind; sie bilden eine wenig dickere, etwas flach gedrückte Keule, die nur so lang ist als die Glieder 2–6; 7. Glied etwas kürzer als das 3., die folgenden viel kürzer, quer, um die Hälfte dicker als lang, das letzte kurz zugespitzt, nur so lang als an der Basis dick.—Kopfschild und Stirn körnigrunzelig punktiert, letztere so lang wie breit, ihr Vorderrand zur Aufnahme der Fühlerwurzeln zweimal ausgerandet. Halsschild jederseits mit zwei Vorderrand-Dornen, die so weit an die Seite gerückt sind, dass sie gegenüber dem Aussenrand der Augen liegen, also weiter innen als bei *Phidodonta*. Diese fast waagerecht liegenden Dornen sind an der Basis verbunden, mässig lang und kräftig, der vordere etwas gekrümmt, in der Mitte des Seitenrandes stehen zwei, an der Basis verbundene, gerade Dornen, die kaum länger als die des Vorderrandes sind, sie sind aber kürzer als der freie 3. Dorn. Scheibe dicht und feinkörnig gerunzelt, mit sehr sparsamer, weisser Behaarung und zwei seichten Quereindrücken, der eine in der Mitte, der tiefere vor der Basis.—Decken nur wenig breiter als der Halsschild, sehr lang gestreckt, mit ganz parallelen Seiter, sehr regelmässigen, fast groben Punktreihen 1–6; Reihe 7–10 unregelmässig, mit kurzen, weissen Härchen in den Punkten, gleichartigen Zwischenräumen und kurzen, scharfen Dornen in den geraden Räumen; Dorne zahlreich, einzelne, sowie die an der Naht kürzer, einige auch an Basis und Schulter, Seiten und Hinterrand mit etwa je 25, ganz gleichartigen, etwas längeren und dünneren Dornen. Die etwas kräftigeren Spitzen-Randdornen kaum

länger als die Seiten-Randdornen, von denen die am Aussenwinkel kurz sind.—Schenkel unten mit einigen Zähnchen.—4½ mm.

3, Kenya Col. Nairobi, vii. 1926 (2 Stück) (*A. F. Gedye*), und Kabete, 28. viii. 1921 (*H. E. Box*).

34. *Pseudispella areolata* Uh. 1, Kenya Col.: Cabete, 28. viii. 1921 (*H. E. Box*). Fühler stärker, Fühlerglieder kürzer als beim Paratypus meiner Sammlung.— 1, Chania Falls, Thika, 5050 ft. (*Gedye*). Entscheidend für die Plazierung ist die erhabene Halsschild-Fläche.

35. *Dactylispa lenta* Ws. 1, Sudan Govt.: Karamota (*Miss M. Steele*), from open country with few bushes.

36. *Dactylispa discreta* Ws. 2, Mombasa (*van Someren*); 2, Nairobi (*Rev. J. W. Hunt*). Letztere beiden Stücke haben dickere Fühler als gewöhnlich, sonst keine weiteren Unterschiede.

37. *Dactylispa aculeata* Klug. 1 ♂, West-Afrika: Principe Insel (*W. H. T. Tams*).

38. *Dactylispa d'Orchymonti* Uh. 1, Fernando Poo (*W. H. T. Tams*).

39. *Dactylispa aureopilosa* Uh. 1, Rabai (*Gedye*). Decken gelbbraun, Randdornen fast ganz gelbbraun, vom Halsschild ist nur die Scheibe schwarz.

40. *Hispa antennalis* Kr. 1 ♂, Uganda: Kampala (*C. C. Gowdy*). 1 ♂, S.-Nigeria: Ibadan (*C. King*).

41. *Hispa vicinalis* Pér. 1, S.-Rhodesia: Zimbabwe, nr. Fort Victoria (*Miss A. Mackie*). 1, Belg. Kongo: Tshibinda (*J. Ogilvie*).

42. *Hispa pavida* Ws. 1, Nyassaland: Chironomo-Ruo (*R. C. Wood*).

43. *Platypria tuberculata* Ach. Auf Grund des Studiums des Typus aus dem Prager Museum ergibt sich Folgendes: Mit *clavareaui* Ws. sehr nahe verwandt und wie *Achard schreibt* "grösser und stärker (8 mm.)," siehe Ann. Soc. Ent. Fr. 86, 1917, p. 71. Die Art ist vor allem breiter. Am besten sind nach meinem Material die beiden Arten am abgesetzten Seitenrand der Decken zu unterscheiden.

Bei *clavareaui* ist er bis zur Hinterecke gleichmässig breit, bei *tuberculata* verbreitert er sich dort, sodass die Hinterecken stärker heraustreten. die Schultererweiterung ist ebenfalls stärker abgesetzt.

3, Uganda : Buloge-Busoga, iv. 1936 (*T. H. C. Taylor*). Diese Stücke unterscheiden sich von denen des Westens durch die mit einem kurzen Spiess versehenen Höcker auf der Vorderhälfte der Decken. Dieser Spiess ist deutlich beim 1. grossen Höcker auf der 1. Rippe und dem hinter ihm, ebenso bei den Höckern der Schulterrippe, auch bei den übrigen Höckern ist die Neigung zur Spiessbildung vorhanden : die Höcker werden dadurch scharfspitzig.

44. *Platypria auromicans* Gest. 2, Belgisch-Kongo: Elisabethville (*J. Ogilvie*).

45. *Platypria centetes* Guér. 2, Uganda : Kampala (*C. C. Gowdey*) ; 4, Sierra Leone : Mosokobi (*E. Hargreaves*), von letzteren haben 2 schwarze Dornen, die bis zur verdickten Basis dunkel sind, dadurch wird eine schwarze Längszeichnung vorgetäuscht. In der Figur 59, p. 125 muss die Erhabenheit 14 auf Raum viii. auf diesem zwischen 12 und 9 eingetragen werden. 3, Sudan Govt. : Umberumbecta, on Toqan tree (*Whitfield*). Diese 2 Stück mit "légère efflorescens blanche," wie Guérin schreibt.

46. *Platypria coronata* Guér. 1, Port. Ostafrika : Lugella (*Hardenberg*), 1 ; Sierra Leone : Niala (*Hergreaves*).

47. *Platypria transvaalensis* Pér. 1, Sudan : Ikotos, 1933 (*Miss M. Steele*).

ASIEN.

Vergleiche die Bemerkung unter Afrika.

48. *Estigmena mannaensis* Uh. 1, Ost-Java : Res. Kediri, Samberbajem. Neu für Java.

49. *Wallaceana apicalis* Gest. (*palmarum* Gest.). 2, Malacca : Penang. Neu für Malacca.

50. *Agonia xanthosticta* Gest. 1, Perak (*Doherty*).

50 *a*. Aberrationen : 2, Perak (*Doherty*). Bei diesen verbreitert sich der 1. Fleck hinter der hellen Basis

bis auf die 2. Rippe, deren Basis ebenfalls hell ist und eine kurze Binde auf der Schulter (5. und 6. Punktreihe) nach dem obengenannten Fleck entsendet, sodass ein heller Ring entsteht. Der Eindruck und sein Seitenrand werden ebenfalls hell, ebenso wird auf dem apikalen Teil der 2. Rippe ein kleiner heller Fleck sichtbar.

50 *b*. Aberration von Borneo : Decken schwarz, gelbbraun : Deckenspitze ; auf der 1. Rippe ein kleiner Basalfleck ; einer in der Mitte und bei einem Stück noch einer hinter ihm. 4, West-Sarawak : Quop (*G. E. Bryant*).

51. *Gonophora* (*Micrispa*) *bryanti*, sp. n. *G. sinuatæ* Gest. affinis, sed nigra, abdomine rufo-piceo, capite prothoraceque opacis, tenuissime reticulatis, elytris nitidulis. Prothorace aliter sculpturato, solum serie apicali transversa punctorum et paucis punctis ante scutum ; linea mediana longitudinali tenuissima utrinque abbreviata ; impressionibus quinque : singulis lateralibus rotundis, duabus transversis post medium, una ante scutum. Elytris ut in *sinuata* sculpturatis.—3–3·5 mm.

Neben *G.* (*M.*) *sinuata* Gest. zu stellen, von der sie sich zunächst durch ihre schwarze Färbung unterscheidet, Bauch düster rotbraun. Kopf und Halsschild aber matt, sehr fein genetzt (schagriniert). Decken glänzend.—Stirn zwischen den Fühlern mit einem sehr feinen Kiel, Augen gewölbt, der seitlich abgesetzte Hals hinter ihnen glatt. Fühler schlank, mit Schmal- und Breitseite, Glied 1 und 2 dicker als die übrigen, gleich lang, 3 länger als 2, am längsten, die übrigen von der Schmalseite wenig voneinander verschieden, zur Spitze kürzer, von der Breitseite Glied 8–10 deutlich quer.—Halsschild-Seiten nicht so stark geschwungen wie bei *sinuata*, vorn mit einer Querreihe von etwas in die Länge gezogenen Punkten, deren äusserste etwas grösser sind, einige Punkte noch vorm Schildchen. Da die Scheibe unpunktiert und in der Mitte eben ist, treten keine Höckerchen hervor wie bei *sinuata* und den anderen *Micrispa*-Arten, der Rand der ebenen Fläche fällt aber zu den Eindrücken steil ab. Je ein Seiteneindruck, jeder wird von den beiden queren Eindrücken hinter der Mitte durch ein Kielchen getrennt. Die queren Eindrücke mit einer Querreihe von Punkten, ein Eindruck noch vorm Schildchen. Mittellinie äusserst fein, beiderseits abgekürzt, Basis mit feiner Querlinie.—Decken im Umriss nicht so stark hinter der Schulter geschwungen wie bei *sinuata*, Rippen wie bei *sinuata*. Jeder Zwischenstreif mit einer Doppelreihe von Punkten und mit Querkielchen ; 2. Streif an der Basis nach aussen verbreitert und dort mit einer Zusatzreihe, diese Bildung auch bei *sinuata* (von Gestro nicht besonders erwähnt) und den mir bekannten *Micrispa*-Arten.—Beine ohne Besonderheiten.

2, Borneo : W. Sarawak, Quop. ii.–iii. 1914 (*G. E. Bryant*).

52. *Gonophora fulva* Gest. 1, Malacca : Perak (*Doherty*). Neü für Malacca.

53. *Dactylispa chaturanga* Maulik. 1, Burma Taungyi. v. 1934 (*Prof. F. J. Meggitt*). Stimmt mit den von Maulik beschriebenen dunklen Stücken aus Burma : Momeit überein.

54. *Dactylispa asoka* Maulik. 1, Siam (*W. R. S. Ladell*). Neu für Siam.

55. *Dactylispa filiola* Ws. 1, Brit. O. Indien : Fraserpot, Coorg, F.R.I. Sandal, 6. ii. 1930 (Insect Survey). Sehr dunkles Stück. Halsschild schwarz, Decken schwarz, auf der Scheibe zwischen den Dornen dunkelbraun, Fühlerspitze und Beine gelbbraun.

56. *Dactylispa fleutiauxi* Gest. 1, Siam : Non Guri (*W. R. S. Ladell*). Neu für Siam.

57. *Dactylispa ramuligera* Chap. 1, Borneo : W. Sarawak, Quop (*G. E. Bryant*). Neu für Borneo.

58. *Dactylispa malayana* Gest. 1, Borneo : W. Sarawak, Quop (*G. E. Bryant*). Diese Art ist nahe verwandt mit *brunnipes* Motsch., *xanthospila* Gest., *drescheri* Ws. und *filiola* Ws.

59. *Dactylispa aspera* Gest. 1, E.-Java : Res. Kediri, Penampean.

60. *Dactylispa marshalli*, sp. n. *D. trigeminæ* Uh. simillima. Rufo-testacea, elytris nigris limbo basali

excepto.—Antennis gracilibus ad apicem vix incrassatis, ceteroqui ut in *trigemina*.—4·75 mm.

Der *D. trigemina* Uh von den Philippinen (40, p. 71 -) äusserst ähnlich, sodass man sie fur eine Aberration dieser Art halten könnte. Ich glaube aber doch, sie vorlaufig als besondere Art ansprechen zu mussen. Unterschiede: (1) Fuhler langer und noch schlanker, zur Spitze nur ausserst wenig verdickt, Glied 8–11 langer, jedes über doppelt so lang wie breit; (2) Decken nicht einfarbig rötlich-braun, sondern schwarz mit schmalem, rotbraunem Basalsaum, (3) der 1. Seitenranddorn des Halsschildes kürzer als der zweite, die Spitzen der Seitenrand-Dornen liegen also nicht gleichweit vom gemeinsamen Ursprung entfernt; (4) Bedornung der Decken in Starke, Grösse und Anordnung wie bei *trigemina*, hinzukommt noch ein schwacher Dorn auf dem 1. Zwischenraum hinter der Skutellarreihe; (5) Punkte in der Reihen grösser und gröber. Holotypus: Borneo; Sarawak, Puak, 2 v. 1914 (*G. E. Bryant*). Paratypus Borneo; W. Sarawak, Quop, iii. 1914 (*id.*).

61. *Platypria echinogale* Gest. 1, Siam (*W. R S. Ladell*). Neu fur Siam.

Folgende Arten, die für Tonkin neu sind, fand ich in einer Sendung des Herrn Pic:
Dactylispa chaturangi Maul., *chinensis* Ws, *platyprioides* Gest., *singularis* Gest. und *Rhadinosa fleutiauxi* Baly.

L.—Rhamphobrachium longisetosum, *sp. n., with some Observations on the Regeneration of the specialized Anterior Setæ.* By E. and C. Berkeley, Pacific Biological Station, Nanaimo, B.C.

The genus *Rhamphobrachium* was established by Ehlers (1887, p. 70) for the species *R. agassizi*, the peculiar character of the genus being the three greatly modified and enlarged anterior somites bearing extraordinarily long slender hooked setæ. He included the species previously described by him under the name *Diopatra brevibrachiata* in the same genus, though he was unable to find the long anterior hooked setæ. He thought it

probable they actually occurred, but had been broken off in his specimens, since he found this was frequently the case in specimens of *R. agassizi*. In the apparent absence of these setæ later authors have included the species *brevibrachiata* in the genus *Onuphis*. *Rhamphobrachium* is a rare genus. Including the two already mentioned only six species seem to have been attributed to it. All of these have been obtained from considerable depths, and the genus is regarded as abyssal.

Recently we have examined two anterior fragments of a species of *Rhamphobrachium* taken off the coast of California, in the neighbourhood of Corona Del Mar, by Dr. G. E. MacGinitie. They represent a new species allied most closely to *R. diversosetosum* Monro and to *R. brevibrachiatum* Ehlers (assuming *R. brevibrachiatum* to have the specialized anterior setæ) *R. longisetosum* is differentiated from the former by the absence of the compound bidentate hook of the fourth parapodium, and from the latter by the much longer anterior setigers and the more complex gills. The specimens were taken in 17 fathoms and 33 fathoms respectively—both very shallow habitats for the genus, judged by previous records. The first, taken off the mouth of the Santa Ana River, measures about 5 mm. long by the same width for nine setigers; the second, taken off Balboa, is 18 mm. long by 4 mm. wide anteriorly, widening to about 6 mm. at the posterior end of the fragment, for 34 setigers. Both are much contracted. One specimen shows no colour-markings as preserved, the other has a broad longitudinal band of pale brown on the prostomium, with traces of spotting of the same colour on the tentaculophores and the dorsal surface of the first few somites.

The anterior tentacles are irregularly ovate. The outer laterals have rather heavy tentaculophores, with subulate styles. The inner laterals have longer and more slender tentaculophores, and the styles are twice as long as those of the outer laterals, reaching to the fourth setiger. The median tentacle is similar to the inner laterals, but shorter. The tentacular cirri are rather long and slender and the palps are large and flattened. Eye-spots occur between the lateral tentacles. The first three pairs of parapodia are much elongated and carried pointing forward, much as figured by Ehlers (1887, pl. xvii.) for *R. agassizi*. They have both dorsal and ventral cirri well developed, and there is, in addition, a cirriform papilla at the distal end of the parapodium. They have also three very small retractile papillæ at the apex, each of which is connected with the emergence of one of the long specialized setæ which these parapodia carry. When these setæ are intact the three anterior parapodia are rounded and rigid, otherwise they are flattened and limp.

On the fourth parapodium the dorsal cirrus remains moderate in size and subulate in form, whilst the ventral cirrus is replaced by a rounded lobe, which disappears on the fifth. The postsetal lobe of the fourth parapodium has a cirriform projection, which becomes smaller posteriorly and disappears at the eighth parapodium. From the fourth back to the thirteenth, at least, the parapodia are sesquiramous, having several fine spines imbedded just beneath the dorsal cirrus, whilst the ventral ramus is supported by about five stouter acicula. The gills are pectinate. They start on the eighth parapodium with one filament. Two filaments are present on the fifteenth parapodium and nine on the thirty-fourth.

The fourth parapodium carries dorsally a bunch of stout curved capillaries, and ventrally similar capillaries, together with compound setæ with slightly toothed ends to the shafts and cultriform blades. No compound bidentate hooks, such as are figured by Monro (1937, p. 196) for *R. diversosetosum*, are present. There are comb-setæ with about twelve teeth. In the thirteenth parapodium the arrangement of setæ is the same except that two heavy bidentate simple hooks are also present. By the thirty-fourth parapodium the compound setæ have disappeared.

The shorter of the two fragments on which this description is based had the specialized long setæ of the anterior segments practically intact. Nine of them were present on one side, equally divided between the three segments, and eight on the other. They are all approximately the same length, projecting straight forward about 40 mm. beyond the parapodia. Ehlers (1887, pl. xvii.) figures only six of these setæ on each side, about 4 mm. in length, for *R. agassizi* and approximately the same number of the same length in *R. chuni* (1908, pl. ix.). Their number seems to be uncertain in other species. In none does the length of those of *R. longisetosum* seem to be approached. All these setæ are similar. Their shafts are about ·05 mm. wide at the base. They taper at the anterior end until about a third of this width, and here there is a partial joint. Above the joint the shaft is perfectly smooth, and continues to taper till it ends in a delicate arched hook. Below the partial joint the shaft bears a double row of fine spines (fig. 1).

On the longer of the two fragments there was no external evidence of the specialized long setæ except a broken shaft of a solitary one on the second setiger on the left side. On dissecting the first setiger of the right side a longer piece of a shaft was found imbedded in the tissue, together with a single separated terminal hook. The parapodium was supported internally by about fourteen acicula, with which were associated the ends of some fine capillaries.

This fragment was marked by a curious feature. Proceeding from its posterior end were six heavy dark processes each about 20 mm. long and 0·4 mm. wide (fig. 2). On following these into the body-cavity of the worm it was seen that they divided into two groups of three and that each group followed along one side of the animal. The group following the right side was dissected out, and it was found that, in the interior of the body, the three processes were so closely pressed together as to apparently coalesce until they reached the three anterior parapodia. Here they again divided, one process branching off to each parapodium (fig. 3).

By careful dissection it was possible to separate one of these processes from the other two, and this (the one leading to the second setiger on the right side) was teased out and examined in detail.

The process was found to consist essentially of a dense bundle of the long setæ, some of them complete and others in various stages of development. The shaft of the longest complete seta dissected out of the bundle was 17 mm. long. The bundle is invested with a very thin reticular membrane, which is reinforced by two groups of six or more clear homogeneous fibres, about 10 μ to 15 μ in diameter, extending the whole length of the bundle. These are the enormously elongated shafts of the capillaries accompanying the acicula in the foot.

The membranous investment terminates posteriorly in a neatly rounded end, and there is nothing to suggest its having been attached at this end to the wall of the body-cavity; but this point could not be definitely determined in the absence of the region of the worm immediately posterior to the fragment under discussion.

Fig. 1.

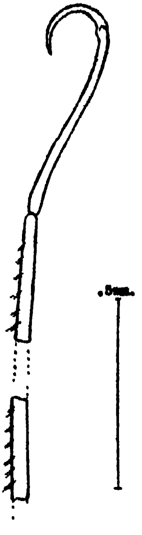


Fig. 2.

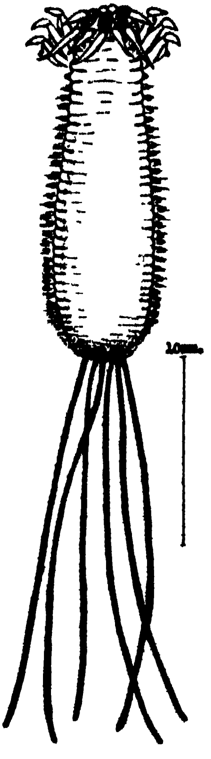
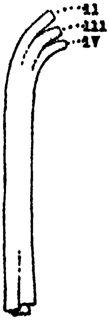


Fig. 3.



Rhamphobrachium longisetosum, sp. n.

Fig. 1.—Hook from anterior setiger.
Fig. 2.—Anterior fragment, with setal bundles projecting.
Fig. 3.—Diagram of anterior end of setal bundles.

The first thing seen on opening the anterior end of the bundle is a row of several of the characteristic terminal hooks of the long setæ set behind one another in series at various distances apart. A concentration of these hooks occurs towards the upper end of the bundle (fig. 4), but occasional hooks are found irregularly placed at any point in this vicinity. Many of the hooks can be traced back along the shaft to a rounded striated termination (fig. 5). Others terminate in a wide bulb simulating a mammalian hair-bulb (fig. 6), and there is a stage in which neither the bulb nor the rounded end can be made out. A number of them could not be traced back to a complete shaft, but disappeared into the bundle at a point a short distance posteriorly to the hook, suggesting that growth was taking place from the hooked end backwards (fig. 7).

Fig. 4.

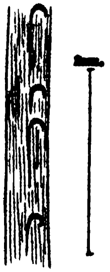


Fig. 5.

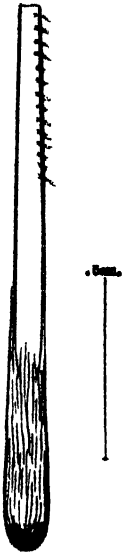
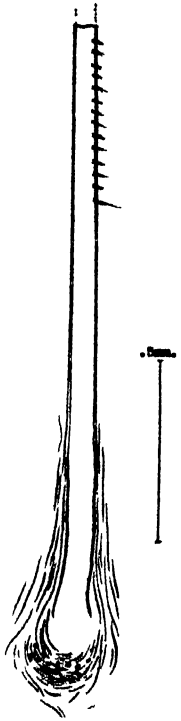


Fig. 6.



Rhamphobrachium longisetosum, sp. n.

Fig. 4.—Anterior end of a setal bundle, showing heads of hooks.
Fig. 5.—Posterior end of a hook.
Fig. 6.—Origin of posterior end of a hook.

The posterior terminations of the hooked setæ are not all at the base of the bundle, but occur at various points along the length of the posterior half. The capillaries, on the other hand, all terminate at the base of the bundle in small bulbs very similar to those of hooked setæ (fig. 8).

The structure appears to provide for the continual and rapid replacement of broken setæ, which is, no doubt, necessitated by their long and frail character. Although the occurrence of replacement setæ in Polychæta is quite general, they are ordinarily found imbedded in the tissue of the parapodium, and we know of no such specific structure for their provision as is present in the case described*.

Fig. 7.

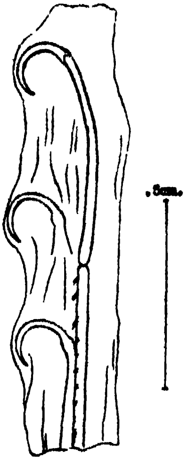
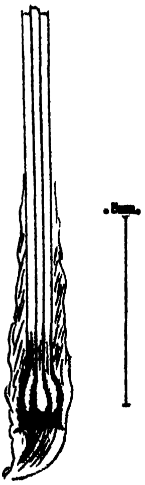


Fig. 8.



Rhamphobrachium longisetosum, sp. n.

Fig. 7.—Portion of a setal bundle, dissected to show anterior ends of hooks, highly magnified.

Fig. 8.—Portion of posterior end of a setal bundle, showing the origin of three capillaries.

McIntosh (1910, p. 409) mentions that two anterior fragments of "*Onuphis*" *brevibrachiata* examined by him had a series of "fibres" projecting from their posterior ends, and suggests that they represent a secretion of the glands of the worm allied to that occurring in *Panthalis*. It seems likely that they were actually the same thing as we have described. If so, it lends probability to Ehlers' surmise that the long setæ actually occurred in the original specimens of *R. brevibrachiatum* examined by him, though they were not detected externally, and justifies his classification of the species.

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* R. A. Hoagland records the observation of "retractor muscles of the hooks with the hooks attached" protruding posteriorly from an anterior fragment of *R. pacifica* (Bull. U.S. Nat. Mus. c. p. 619). These also were, no doubt, the same thing.

A portion of the tube of *R. longisetosum* accompanying one of the fragments we have described indicates that the worm inhabits a parchment-like tube covered with fine sand, foraminifera, and vegetable growth. The projecting end is bent over into a cowl with an oval aperture.

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LI.—*Lake Albert Fishes of the Genus* Haplochromis.

By ETHELWYNN TREWAVAS, D.Sc., Assistant Keeper in the British Museum (Natural History).

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INTRODUCTION.

The recently published memoir, by Drs. David and Poll, on the African fishes collected by Dr. Schouteden (Ann. Mus. Congo Belge, (1) iii. pp. 189–293 (1937)) contains descriptions and figures of two new species of *Haplochromis* from L. Albert. This has led me to examine the

British Museum material from the lake, with some results which seem to be worth a note.

I wish at once to express my gratitude to Dr. Schouteden and Dr. David, who have very kindly lent the type of *Haplochromis mahagiensis* for comparison, and have presented to the British Museum (Nat. Hist.) two specimens determined by Dr. David as young *H. mahagiensis*. I wish also to thank Mr. J. E. Webb, of this Museum, who has examined the contents of the gut in three species.

Previously three species of *Haplochromis* were recorded from L Albert—namely, the upper Nile species, *H. wingatii* (Boulenger), and two endemic species, *H. albertianus* Regan and *H. avium* Regan. Examination of the thirty specimens on which *H. albertianus* was based showed that two species had been confused under this name. The name *H. albertianus* is here restricted to the species represented by specimens in which the pharynx had been dissected, and a new name, *H. bullatus*, is given to the other. The most striking peculiarity of *H. bullatus* is the enlargement of the mucus-canals and the bullate swelling of the pro-otic bones. This has more than once been used as a generic character in the family Cichlidæ, but the close relationship of these two species makes it unjustifiable to do so here.

From their material, David and Poll concluded that the enlargement of the pharyngeal teeth in *H. mahagiensis* characterizes only well-grown specimens, being very slight in half-grown fish and non-existent in young. However, a half-grown fish in the British Museum (Nat. Hist.) that appears to belong to this species already has massive pharyngeals. I have therefore assigned young fish with only slightly enlarged pharyngeals to *H. wingatii*, the type of which has also a slight enlargement of posterior teeth—a fact which has not hitherto been noted in the descriptions.

In trying to define the limits of *H. wingatii*, I have come to the conclusion that the fish described by me in 1933 as type of the species *H. dolorosus* is undoubtedly a large specimen of *H. wingatii*, one of intermediate size from the Ruwenzori region forming a connecting-link between the two unique types. Large series of this species from the Bahr-el-Jebel and from L. Albert are desirable before possible differences between lake and river forms can be appreciated.

A good series of *H. avium* is also among the desiderata for our collections. The type of this species and that of *H. lanceolatus* David and Poll are both poorly preserved, but I believe them to represent a single species.

Perusal of the lists of specimens of each species will convey to the scientific collector a warning against unconscious selection on his part of the active, brightly-coloured males! It seems possible that in *H. bullatus*, at least, the females may remain smaller than the males, as well as more soberly coloured.

Worthington ('A Report on the Fishing Survey of Lakes Albert and Kioga,' Crown Agents, p. 92 (1929)), in his list of the fishes of L. Albert, includes parenthetically a note on *Haplochromis multicolor*, in order to note an unconfirmed record of this species in L. Albert. *H. multicolor* is known from the Nile, including Bahr-el-Jebel, from the Semliki River on the upper (Lake Edward) side of the Rapids, and from the swampy lakes west of L. Victoria, but not from L. Albert or L. Edward. It is probably an essentially fluviatile species, with no inclination to colonise lakes. It is easily distinguished from the L. Albert species by its larger scales (25 to 28 in longitudinal series) and wider interorbital region (3 to nearly 4 in length of head).

The *Haplochromis* of L. Albert belong to a group having 28 to 32 scales in longitudinal series and 22 to 25 dorsal rays (D. XIII–XV 8–11).

SYNOPSIS OF THE SPECIES OF *HAPLOCHROMIS* INHABITING L. ALBERT.

I. **Interorbital width 4 to 5 in length of head.**
  Pharyngeal teeth slender, a few slightly enlarged in older specimens . . . . 1. *wingatii.*
  Lower pharyngeals massive, with large flat teeth. 2. *mahagiensis.*
II. **Interorbital width 5⅓ to 6⅓ in length of head.**
  A. **Diameter of eye 3⅔ in length of head; lower pharyngeal teeth slender, pointed (at 43 mm. standard length)** . . . . 3. *avium.*
  B. **Diameter of eye 3 to 3⅔ in length of head (at 43 to 75 mm. standard length); at least some pharyngeal teeth enlarged.**
    Mucus-canals not swollen; upper gill-rakers conical . . . . 4. *albertianus.*
    Mucus-canals swollen; upper gill-rakers expanded or bifid . . . . 5. *bullatus.*

H. wingatii, of the upper Nile, is the only one of these species not confined to the lake. *H. mahagiensis* appears to have evolved directly from *H. wingatii* by enlargement of the pharyngeal teeth, associated with specialization in diet. The other three species are closely related to each other, and are not very remote from *H. wingatii*, but it is impossible to assert that they too have evolved from this Nilotic species.

Haplochromis wingatii (Boulenger).

Paratilapia wingatii Boulenger, Ann. & Mag. Nat. Hist. (7) x. p. 264 (1902).
Haplochromis desfontainesii (part.) Boulenger, Cat. Afr. Fish. iii. p. 302 (1915).
Haplochromis wingatii Regan, Ann. & Mag. Nat. Hist. (9) x. p. 261 (1922).
Haplochromis dolorosus Trewavas, J. Linn. Soc. London, xxxviii. p. 338 (1933).

Depth of body a little more than 3 in the length, length of head 3. Snout 3⅜ in length of head, a little less than diameter of eye, which is 3⅖ in head. Depth of præorbital 6 in length of head, interorbital width 4½, length of lower jaw 2⅜. Jaws equal anteriorly, maxillary extending to below anterior ¼ of eye. Teeth in 3 or 4 series above, 3 below, outer conical or unequally bicuspid, with main cusp acute, 34 in outer series of upper jaw. 8 gill-rakers on lower part of anterior arch. Lower pharyngeal teeth mostly compressed and bicuspid, including the large middle posterior pair, but two pairs of teeth immediately in front of these with stout cylindrical bases, which retain the main cusp. 4 series of scales on the cheek. 30 scales in longitudinal series, 4½ from origin of dorsal to lateral line, 7 between pectoral and pelvic fins. Dorsal XV 10; last spine nearly ½ length of head. Anal III 8; third spine scarcely shorter than last dorsal. Pectoral about ¾ length of head, extending to above vent. Caudal subtruncate. Caudal peduncle 1¼ as long as deep. Two bars across top of snout; a vertical bar from eye to angle of lower jaw; a horizontal dark bar from eye to opercular spot; an elongate dark patch on anterior part of lower lateral line, another at base of caudal; a median dark spot on nape, and three dark patches in basal part of dorsal fin. Five or six * faint vertical bars between opercular spot and first lateral blotch. Caudal spotted; anal with three bright ocelli.

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* Five on left side, traces of a sixth on right, in type.

Described from a single specimen, the type, 54+13 mm. long, from Gondokoro, Bahr-el-Jebel (coll. Loat).

The type and six young fishes from the same locality were the only specimens of this species found by Mr. Loat "in spite of diligent search" (Boulenger, 1902). In the young (36+7½ mm. or less) the pharyngeal teeth are all small, compressed, and pointed, but they probably belong to this species, in which they were placed by Regan.

Eight other specimens in the British Museum (Nat. Hist.) are referred to this species, namely :—

(i.) and (ii.). Two males from the Ruwenzori region, the first, 61+14 mm. long, from the Hima R., flowing into L. George, the second, type of *H. dolorosus*, 96+22 mm. long, from the Chambura R., flowing into the Kazinga Channel. In both the middle pharyngeal teeth are stout at the base, but retain a pointed cusp. In the Hima fish the outer teeth of the jaws are bicuspid, with the main cusp acute, whereas in "*H. dolorosus*" the outer teeth are all conical. The length of the lower jaw in the Hima fish is contained 2½ times in the length of head—a ratio intermediate between that in the type of *H. wingatii* and "*H. dolorosus*." These three fishes are distinguished from their purely lacustrine relative, *H. nubilus*, by their rather slender form (depth 2⅞ to more than 3 in the length), by a rather narrow interorbital region (4 to 4½ times in the head), and by some degree of enlargement of the phanyngeal teeth. In large males of *H. nubilus* the jaws become heavy and the maxillary becomes rather broad, but this is less marked than in *H. wingatii* and is not accompanied by simplification of the teeth.

In the Hima fish the dorsal rays number XV 10, the anal III 10. The type of *H. dolorosus* agrees with that of *H. wingatii* in fin-counts.

(iii.) A male, 61+14 mm., from Packwach, Albert Nile, in which the body is a little deeper than in the type (depth 2¾ in the length). The middle posterior pharyngeal teeth are somewhat enlarged and some are blunt. The interorbital width is contained 4 times in the length of head, the diameter of the eye a little over 3½ times.

(iv.) and (v.). Two small fishes, 44+10 and 46+22 mm. long, from Lake Albert. In these the pharyngeal teeth show no sign of enlargement, and the depth of the body is contained 2½ or 2⅔ times in the length. I place them in *H. wingatii* with considerable doubt, and would have referred them to *H. nubilus*, if this species had been known to occur in L. Albert.

(vi.) A specimen of 38 + 9 mm. from L. Albert. The two middle pairs of pharyngeal teeth before the last are enlarged and two of these have lost their cusps. The lower part of the cheek is naked. There are 7 gill-rakers and a minute rudiment on the lower part of the anterior arch.

(vii.) and (viii.). Two fishes, 44 + 9 mm. (♂) and 47 + 10 mm. (♀) long, from Lake Albert, presented to the British Museum by Dr. Schouteden. They were believed by Dr. David to be the young of *H. mahagiensis* (q. v.), but in the degree of enlargement of the pharyngeal teeth they agree with *H. wingatii*, which they also resemble in other characters. To this species they are now referred. The female has no dark spots on the side, nor at the base of the dorsal fin, and no anal ocelli, but the markings on the head are as in the male.

Haplochromis mahagiensis David & Poll.

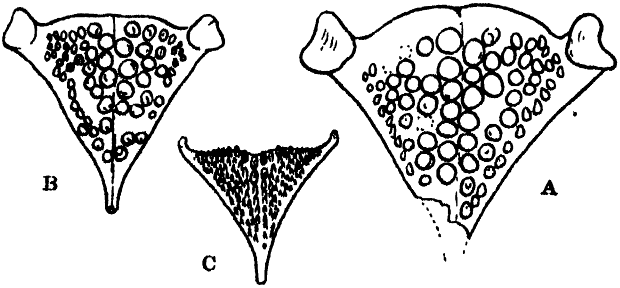
Haplochromis mahagiensis David & Poll, Ann. Mus. Congo Belge, (1) iii. p. 251, fig. 27 (1937).

Depth of body 2¾ in the length, length of head 2⅝. Snout a little longer than diameter of eye, which is 4¼ in length of head. Depth of preorbital 5⅔ in length of head, interorbital width 4⅔, length of lower jaw nearly 2⅓. Teeth in 3 series, outer unequally bicuspid, except a few at posterior end of premaxillary; 42 in outer series of upper jaw. Maxillary extending to a little beyond anterior edge of eye; lower jaw very slightly prominent. 6 gill-rakers on lower part of anterior arch. Scales of cheek small, not or but slightly overlapping, in 2 or 3 series, leaving a naked area antero-ventrally. Pores of lateral line organs very small. Lower pharyngeals massive, united by sinuous suture, bearing enlarged teeth with flat crowns (fig. 1 A). 30 scales in longitudinal series, 5 from origin of dorsal to lateral line, 5 or 6 between pectoral and pelvic fins. Dorsal XIV 10; last spine ⅖ length of head. Anal III 8, third spine about as long as last dorsal. Pectoral ⅔ length of head, extending to above vent. Caudal rounded. Caudal peduncle a little longer than deep. General colour greyish; a dark vertical bar below eye and one on preoperculum; an opercular spot; faint traces of five or six transverse bars on body and of a dark spot at base of caudal. Dorsal grey with black lappets; anal with three bright ocelli posteriorly; pelvics dark.

Described from the type, a male of 72+15 mm. (Congo Museum, Tervueren), from Mahagi, L. Albert.

Drs. David and Poll included in the species also a number of younger fish, in which the pharyngeal teeth were much smaller, showing no enlargement at all in very small specimens. Two specimens determined by them and presented to the British Museum (Nat. Hist.), a male of 44+9 mm. and a female of 47+10 mm., do indeed resemble the type closely, except in having 8 gill-rakers in place of 6, and in having the pharyngeal teeth all pointed, a few middle posterior teeth being slightly enlarged (fig. 1 C). These characters place them with *H. wingatii*, q. v.

Fig. 1.



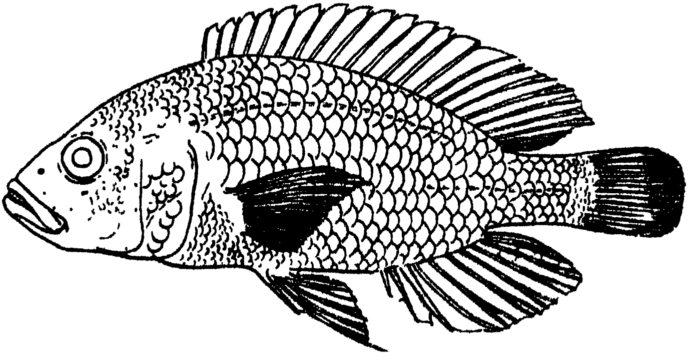
Lower pharnygeals, ×4, of: A, *Haplochromis mahagiensis*, type, 72+15 mm.; B, *Haplochromis mahagiensis*, 48+11 mm.; C, *Haplochromis wingatii*, 47+10 mm. (sent from Tervueren as young *Haplochromis mahagiensis*).

A male of 48+11 mm. collected by Worthington in L. Albert, has, however, a better claim to be regarded as the young of *H. mahagiensis*, as it already possesses a heavy grinding pharyngeal apparatus. A description of it follows:—

Depth of body nearly 3 in the length, length of head 2⅔. Diameter of eye 3⅓ in length of head, depth of preorbital 6¼, interorbital width 5, length of lower jaw nearly 2½. Teeth in 3 series, outer unequally bicuspid, 32 in outer series of upper jaw. Cheek with one or two series of small scales and a large naked area. 6 gill-rakers on lower part of anterior arch. Pharyngeals massive, bearing enlarged flat-crowned teeth (fig. 1 B). 31 scales in a longitudinal series, 6 from origin of dorsal to lateral line; scales of chest very small. Dorsal XV 9. Anal III 8. General ground-coloration pale; head-markings as in type, with the addition of two bars on the snout; a dark patch at base of caudal and another on anterior part of lower lateral line; eight or nine conspicuous transverse bars, of which five are in front of the patch on lower lateral line; a dark patch on nape and three dark basal patches on spinous dorsal; anterior dorsal lappets dark.

The stomach is empty. The intestine is short (35 mm.) and contains shells of gastropods and bivalves (some of which, surprisingly enough, have passed through the pharyngeal mill unbroken), a few fragments of crustacean limbs, some very small eggs, and a few branching horny filaments, perhaps of a polyzoan, some at least of which are attached to a gastropod shell. The whole content is impregnated and held in a hard mass by botryoidal aggregates of calcite. Whether these were formed before or after death and fixation is a matter of conjecture *.

Fig. 2.



Haplochromis mahagiensis, type.

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* Is this perhaps a method of excreting excess calcium, such as might well be absorbed by a fish having such a diet?

The preoperculum of one side in this fish has an outgrowth invading the cheek. This is probably an extravagance in the general strengthening of the bones giving attachment to the strong pharyngeal muscles.

All the differences between this specimen and the type are such as may well be correlated with age, and none of them is so striking as the difference between the pharyngeals of this fish of 48 mm. and the 47 mm. fish believed by David and Poll to be the young of *H. mahagiensis* (fig. 1). It therefore seems best to restrict the name to fishes with massive pharyngeals, at least at a standard length of 48 mm. or more.

Haplochromis avium Regan.

Haplochromis avium Regan, Ann. & Mag. Nat. Hist. (10) iii. p. 389 (1929).

? *Haplochromis lanceolatus* David and Poll, Ann. Mus. Congo Belge, (1) iii. p. 252, fig. 28 (1937).

Depth of body 3 in the length, length of head 2⅔. Snout somewhat longer than diameter of eye, which is 3⅔ in length of head. Depth of præorbital 6 in length of head, interorbital width 5⅓, length of lower jaw 2⅓. Lower jaw slightly prominent, strong; maxillary extending to below anterior ⅓ of eye. Teeth in three series, outer rather strong, unequally bicuspid or conical, about 35 in outer series of upper jaw. Mucus-channels of head not enlarged. 3 series of scales on the cheek. 7 gill-rakers on lower part of anterior arch. Lower pharyngeal teeth compressed and pointed. 29 scales in a longitudinal series, 6 from origin of dorsal to lateral line. Dorsal XIV 10*; last spine ⅓ length of head. Anal III 8; third spine as long as last dorsal. Pectoral ⅔ length of head, not reaching anal. Caudal rounded (?). Caudal peduncle a little longer than deep. Greyish; a dark bar below eye; two ocelli on posterior part of anal; pelvics blackish. Very faint traces of a dark band along middle of side, and of another on upper lateral line.

The type, a male 43+9 mm. in total length, was taken from the stomach of a cormorant from L. Albert.

The description of the type of *H. lanceolatus* corresponds very well to *H. avium*, the position of the mouth giving the head, and hence the whole fish, an appearance of greater length than would be normal. The dorsal rays number XV 9. It agrees with *H. avium* and differs from

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* This count differs from that of Dr. Regan (XVI 9). The specimen is damaged at the anterior end of the dorsal and it is impossible to be sure whether or not the first ray now present was originally preceded by another.

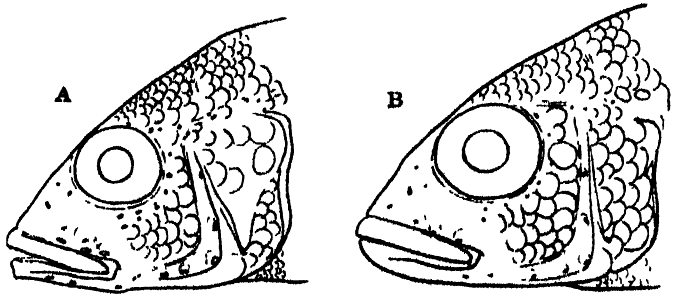
H. albertianus and *H. bullatus* in the relatively small eye and the small pharyngeal teeth. In addition, it differs from *H. bullatus* in not having the mucus-canals enlarged. *H. avium* differs from *H. wingatii* in the larger head and larger mouth, and in the absence of any enlarged teeth in the pharynx.

Haplochromis albertianus Regan.

Haplochromis albertianus (part.) Regan, Ann. & Mag. Nat. Hist. (10) iii. p. 389 (1929).

Depth of body 3 or a little more in the length, length of head from a little less than 3 to 3⅙. Snout as long as or shorter than diameter of eye, which is 3 to 3¼ in length of head. Depth of præorbital 6⅓ to 6⅔ length of head, interorbital width 5⅕ to 5⅓, length of lower jaw from a little more than 2 to 2¼. Jaws equal anteriorly: lower without a strong mental tubercle; maxillary extending to below anterior ¼ or ⅓ of eye. Teeth in 3 series, the outer curved, conical, 46 to 50 in upper jaw, the inner minute, tricuspid, with the middle cusp much stronger than the lateral. Scales of cheek in 3 to 5 series. 7 or 8 short conical gill-rakers on lower part of anterior arch. Lower pharyngeal bones strong, in the larger specimens united by a sinuous suture; teeth, except at the lateral corners, large, flat-crowned. 31 or 32 scales in longitudinal series, 5 or 5½ from origin of dorsal to lateral line. 6 or 7 between pectoral and pelvic fins. Dorsal XV 9–10; last spine 2¼ to 2⅗ in length of head. Anal III 7–8;

Fig. 3.



Heads of: A, *Haplochromis bullatus*; B, *Haplochromis albertianus*. Nearly twice natural size.

third spine shorter than last dorsal. Pectoral shorter than head, extending to above vent. Caudal rounded. Caudal peduncle not more than 1⅓ times as long as deep. Colour silvery, a little darker above; two dark bands across top of snout, a dark patch on nape, a vertical dark bar below eye, a dark patch on preoperculum, and an opercular spot. Spinous dorsal with dark lappets, soft dorsal with dark membrane between light rays, the dark colour sometimes broken into spots posteriorly; caudal spotted; anal clear, or sometimes with one to three pale, oval, inconspicuous spots; pelvics dusky; pectorals clear.

Six of the types, 54 + 13 to 75 + 19 mm. in total length, from L. Albert (coll. Worthington). These are the only types (syntypes) of the species as now restricted; they are all males, and at least some of the features of the colour-pattern are doubtless restricted to that sex. One of them is in the Belgian Congo Museum, Tervueren, the others are in the British Museum (Nat. Hist.).

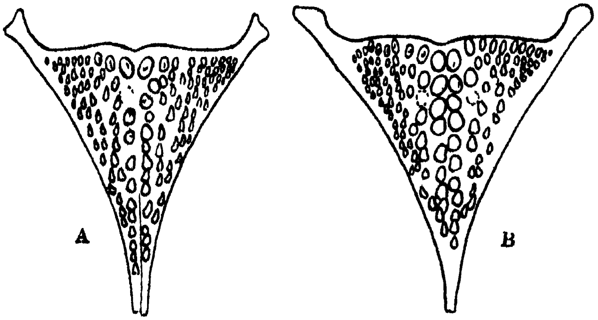
Examination of the gut in two specimens shows these to be carnivorous fishes, with a short intestine, 60 mm. in a fish of 65 mm. standard length, 70 mm. in a 70 mm. fish. The stomach contained broken bivalve shells in both, some small crustacea in one and remains of an insect abdomen in the other, and in both some small (0·2 × 0·25 mm.), brown, elongate eggs, a few fragments of tissue from a vascular plant, and a considerable quantity of sand-grains.

Haplochromis bullatus, sp. n.

Haplochromis albertianus (part.) Regan, Ann. & Mag. Nat. Hist. (10) iii. p. 389 (1929).

Depth of body 3 or a little more than 3 times in the length, length of head 2¾ to 3. Snout a little shorter than diameter of eye, which is 3 to 3⅔ in length of head. Depth of preorbital 5¼ to 6⅓ in length of head, interorbital width 5⅓ to 6½, length of lower jaw 2⅙ to 2¼. Jaws equal anteriorly, lower with a distinct mental tubercle; maxillary extending to below anterior part or middle of eye. Teeth in 3 or 4 series, outer unequally bicuspid or, occasionally, conical, inner much smaller, tricuspid. Bones of head with mucous-channels and their orifices enlarged. 3 or 4 series of scales on the cheek. 6 or 7, rarely 8, gill-rakers on lower part of anterior arch, the lowest usually minute, one to four of the uppermost usually expanded or bifid distally. Lower pharyngeal teeth of two, sometimes four, middle series enlarged, the posterior middle pair pointed, some others blunt in older specimens. 28 to 32 (usually 30 or 31) scales in a longitudinal series, 4 or 5 from origin of dorsal to lateral line, 5 to 8 between pectoral and pelvic fins. Dorsal XIII–XV 8–11 ; last spine 2¼ to 2⅜ in length of head. Anal III 7–9 ; third spine shorter than last dorsal. Pectoral shorter than head, extending to above anal spines. Caudal rounded or subtruncate. Caudal peduncle 1⅓ to 1½ as long as deep. General coloration (♂) somewhat dusky ;

Fig. 4.



Pharyngeal bones of : A, one of the largest specimens of *Haplochromis bullatus* (length 64+15½ mm.), and B, one of the smaller *Haplochromis albertianus* (65+15½ mm.). × 6.

below eye an ill-defined dark vertical bar ; an opercular spot ; operculum and branchiostegal membrane dusky. Dorsal fin with dark lappets, below which is a narrow light band ; soft dorsal and caudal spotted ; anal usually with one or two round grey spots, sometimes ocellar. Pelvics dusky.

Described from twenty males, some of the types of *H. albertianus*, 42+12 to 65+15 mm long. (coll. Worthington).

Females.—Four smaller fishes, 40+10 mm. to 46+11 mm. are the only females known. These have well-developed ovaries, and in two the ova are very large and apparently ripe. They differ from the males in having a pale general coloration, including branchiostegal membranes and pelvic fins. The markings of the other fins are as in males, but the spot on the anal is present in only one specimen and is not well defined. Some or all of the outer teeth of the jaws are tricuspid, but this is probably a juvenile rather than a sexual character, for the male of 48 + 12 mm. has a few of the outer teeth tricuspid. The middle pharyngeal teeth (examined in two) are only slightly weaker than those of the smallest male.

All these specimens, 20 males and 4 females, are regarded as syntypes of the species. One of them, a male, is now in the Congo Museum, Tervueren, the rest are in the British Museum (Nat. Hist.).

This species is easily distinguished from *H albertianus* by the enlarged mucus-channels of the head. In addition, the preorbital bone is wider in fishes of the same size, the upper gill-rakers are longer and usually expanded, and the lower may be more rudimentary than in *H. albertianus*. Although the number of specimens of *H. albertianus* is rather low for such comparisons, it appears that higher numbers of dorsal spines prevail in that species, in which all six specimens have XV. Only one specimen of *H. bullatus* has XV spines, eleven have XIV and seven have XIII. In *H. albertianus* five specimens have a total of 24 dorsal rays, the sixth has 25. In *H. bullatus* the total is 22 in one, 23 in twelve, and 24 in six.

Food.—The gut has been examined by Mr. Webb in six specimens. The length of the intestine was in each less than the standard length of the fish. Small crustacea were present in five specimens, remains of small moths in four of these, and of other insects in three. Few or many quartz granules were found in most, and in four there were very small eggs. In one of these the eggs formed the large proportion of the recognizable food; they were embedded in gelatinous fibres. Pieces of broken bivalve shells in two and a small annelid in one complete the list of recognizable food.

Haplochromis sp. ? (young).

Seven fishes, 24 + 6 to 31 + 8 mm. long, were taken, with the type of *H. avium*, from the stomachs of Lesser Cormorants. They are too young for certain identification, but the five in which the standard length is 27 to

31 mm. all show enlargement of about 4 middle pharyngeal teeth. One of these has stouter pharyngeal bones than the others, and has rather large mucus-channels. It may be *H. bullatus*, but, with the others, is at present catalogued under *H. wingatii*.

The birds, like the human collectors, would appear to have selected males, for all these and the type of *H. avium* have bright ocelli on the anal fin.

It is of some interest to find that enlargement of pharyngeal teeth is apparent at so early a stage. It still remains for us to find a series decreasing in size from the 48+11 mm. specimen of *H. mahagiensis* before we know how early this species may be differentiated from *H. wingatii*.

ECOLOGY.

Worthington ('Report on the Fishing Survey of Lakes Albert and Kioga,' Crown Agents, London, p. 93 (1929)) states that *H. albertianus* "was never taken near the shore," that it is abundant in the deeper waters, where it was taken near or at the bottom in three depths, 7 to 10 metres, 23 metres, and 40 metres. It is unfortunate that *H. bullatus* was not then recognized as distinct, for it would have been of great interest to know whether the enlargement of the cavities of the lateral line system is associated with a life in deeper water *. Probably Worthington had also among his ecological material the third species, *H. mahagiensis*, to which may well have belonged many of the stomachs examined in the field, and found to contain broken mollusc-shells; but this species would hardly be expected in the 23 and 40 m. trawlings, for at the type-locality, Mahagi, the 20 m. line is at a considerable distance from shore (see Map 2, Worthington, *t. c.*).

We have, in L. Albert, in a simpler form, the same problem of evolution which in Lakes Victoria and Nyasa is so baffling by reason of the large numbers of species. At present we have the ecological position shown in the table (p. 449), almost every detail of which needs verification or expansion by field-work upon the firmer (but still incomplete) systematic basis now available.

* Enlargement of mucus-channels is unknown among the Cichlid species of the shallower lakes, Victoria and Edward, but has occurred twice in L. Nyasa and perhaps oftener in Tanganyika.

Ecological Review of Lake Albert Fishes of the Genus Haplochromis.

Species	*H. wingatii.*	*H avium.*	*H. mahagiensis.*	*H albertianus.*	*H. bullatus.*
Habitat	Rivers and lake shores.	Shores	Shallow water.	Deeper water.	Deeper water.
Diet	Insects and small crustacea.	Unknown.	Mollusca.	Mollusca, some small crustacea, and incidental miscellanea	Small crustacea, mollusca, insects, and worms.
Dentition : jaws	Fairly strong.	Strong.	Moderate.	Conical seizing teeth.	Strong in adult, weak in young.
pharynx .	Adapted for holding and light crushing.	Pointed holding teeth.	Crushing.	Crushing, but less strong than in *H. mahagiensis.*	Adapted for holding and light crushing
Other notes	More material may allow the distinction of fluviatile and lacustrine forms, the lacustrine having deeper body and weaker jaws.	Structurally resembles the piscivorous type, which in Lakes Victoria and Kivu has departed farther from a generalized *Haplochromis*	....	Eyes large ; young and females unknown.	Eyes large ; mucus-cavities swollen , known females smaller than males.

LII.—*Notes on the Genus* Clephydroneura *Becker* (*Diptera*: Asilidæ). By H. Oldroyd, B.A., F.R.E.S., Department of Entomology, British Museum (Natural History).

Becker (1925, p. 68) founded the genus *Clephydroneura* in the following terms :—

Randader schwarz, verdickt, Adern uberhaupt sehr stark. Gesichtshöcker sehr klein, auf den Mundrand beschränkt, Mesonotum Kahl, Schildchen fast nackt. Ockergelb gefärbten Arten mit verhältnismässig nackten, gelben Beinen. Epipyg sehr gross, fussförmig	[Herm. in litt. *Clephydroneura*, n. g.,
Randader nicht verdickt, aber mässig erweitert. Gesichtshocker ganz fehlend. 3 Fuhlerglied von mässiger Länge. Epipyg nicht gross und nicht nach oben fussförmig aufgebogen. Zweite Hinterrandzelle nach vorne nicht erweitert, tritt auch nicht in die erste Hinterrandzelle hinein. Kleine, schwarzgraue Arten mit dunklen ziemlich beborsteten Beinen	*Synolcus* Lw.

Engel (1929, p. 143) pointed out that this diagnosis separated off the Asiatic species formerly placed in *Synolcus* by Wulp, Kertész, and Ricardo, and also stressed the importance of the metanotal hairs which are present in *Clephydroneura* and absent in *Synolcus*.

No species appear to have been placed in this genus until Frey (1934, p. 317) referred to it *Asilus xanthopus* Wied. and *A. bengalensis* Macq. Under Opinion 46 of the International Commission on Zoological Nomenclature one of these two species must be selected as type, and I hereby select *Asilus xanthopus* Wied. (1819) as type of *Clephydroneura* Becker (1925).

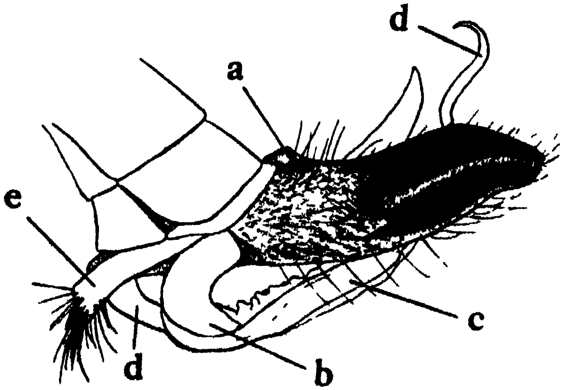
The genus closely resembles *Cinadus* Wulp, but is distinguished by the pronounced bulging of the fourth posterior cell into the discal cell which is thereby narrowed at its middle. The costal and radial veins are thickened, especially in the male, where they run close together, and where the fore margin of the wing is more or less dilated.

Face moderately produced immediately above mouth margin. Moustache rather sparse, usually white, and containing mainly strong bristles. Antennæ with cylindrical first segment, short bulbous second, and elliptical third, with a two-segmented arista, of which the first segment is very short. The fore femora have a row of bristles below, which are usually pale and weak in the male and often black and strong in the female.

The genus includes not only the yellow forms mentioned by Becker, but also a number of black species similar in general appearance to the African species of *Synolcus*. All, however, agree in having the face protruding and the metanotal callosities each with a tuft of hair. The males of the different species are readily distinguished by the form of the upper forceps in dried specimens, while dissection of the terminalia reveals quite sharp differences, especially in the structure of the ædeagus and claspers.

The females are much more difficult to separate, especially those of *xanthopus* and its allies, which have no distinctive colour-pattern on the legs. The general coloration is unreliable, and species with very distinctive male terminalia may be almost inseparable in the female.

Fig. 1.



Terminalia of *Clephydroneura minor*, sp. n., in side-view (for explanation see text).

STRUCTURE OF THE MALE TERMINALIA.

Structures which show good specific differences include: (*a*) the upper forceps, seen from above, or cleared and mounted; (*b*) the lower forceps; (*c*) the claspers; (*d*) the ædeagus, which is generally trifid, but shows considerable diversity of form; (*e*) the eighth sternite which is sometimes inconspicuous, sometimes downturned and bearing a conspicuous tuft of hair.

The following eight names are available for species of this genus :—

Asilus annulatus Fabr. (1775). India.
—— *xanthopus* Wied. (1819). Java.
—— *bengalensis* Macq. (1839). Bengal.
—— *duvaucelii* Macq. (1839). Bengal.
—— *flavicornis* Macq. (1839). Bengal.
—— *barium* Walk. (1849). Ceylon.
—— *iamenus* Walk. (1849). N. Bengal.
—— *sundaicus* Jaenn. (1867). Java.

ACKNOWLEDGMENTS.

The present study is based mainly on material in the collections of the British Museum (Natural History), and, except where otherwise stated, all types and paratypes are deposited there. In addition, I wish to offer my sincere thanks to the following gentlemen for their assistance :— To Dr. Max Beier of the Naturhistorisches Museum, Vienna, for the loan of the types of *Asilus xanthopus* Wied.; to Dr. S. W. Bromley and Mr. H. M. Pendlebury for the use of material belonging to the Selangor Museum, Kuala Lumpur; to Mons. A. Collart of the Musée Royal d'Histoire Naturelle, Brussels, for the loan of specimens named by van der Wulp, and of unnamed material from Cochin China; to Dr. B. M. Hobby for the use of specimens from the University Museum, Oxford.

The material studied also includes collections made by two successive expeditions to S. India (1936 and 1937), organised jointly by the British and Colombo Museums, and led by Mr. G. M. Henry. This material is indicated by the note "*(B.M.-C.M. Exped.)*," and half the paratypes in it are being returned to the Colombo Museum.

I am especially indebted to Dr. F. W. Edwards and Dr. B. M. Hobby for reading the manuscript of this paper, and for much helpful advice.

Key to the Genus Clephydroneura *Becker.*

1. Wings infuscated at tip and along hind margin, forming a sharply defined greyish area .... 5.
   Wings not at all infuscated, though they may have a yellowish stain .... 2.
2. Female with black bristles in moustache, and with black abdominal hairs and bristles .... 17. *brevipennis*, sp. n.

	Both sexes with moustache entirely white; most of abdominal hairs and bristles black	3.	
3.	Female with seventh abdominal tergite bare and shining in middle; male with both seventh and eighth so shining	18.	*gymnura*, sp. n. ✓
	Seventh tergite of both sexes uniform with others	4.	
4.	Fore femora with a short black stripe in front, spreading into a subapical ring. Thorax with yellow ground-colour, and generally a pink tinge. Fore femora below (♀) with white bristles	10.	*duvaucelli* Macq. ✓
	Fore femora with sharply defined longitudinal stripe, but no apical ring. Ground-colour of thorax black. Fore femora (♀) with black bristles	11.	*flavicornis* Macq. ✓
	(Femora mainly black	12.	Var. *fusca*, nov.) ✓
5.	Legs largely black, at least in front	6.	
	Legs mainly yellow or reddish, especially tibiæ	8.	
6.	Legs entirely black, except possibly at knees	14.	*pulla*, sp. n. ✓
	Femora black in front, reddish yellow behind and at base	7.	
7.	Moustache entirely white	13.	*semirufus*, sp. n. ✓
	Moustache with black bristles	19.	Sp. indet.
8.	Femora yellow, black only very narrowly at knees, though hind pair sometimes more extensively black	11.	
	Middle and hind femora with a broad black apical band	9.	
9.	Fore femora entirely yellow, without trace of black ring. Wing-infuscation extending well into fifth posterior cell (fig. 3 *b*)	10.	
	Fore femora with a trace of black band or short stripe in front. Wing-infuscation scarcely extends into fifth posterior cell (fig. 3 *a*)	9.	*annulata* Fabr. ✓
10.	Slender species, with mesonotum, fore half of pleura, and dorsum of abdomen black. Wings in male feebly dilated. Fifth posterior cell narrowly infuscated	16.	*exilis*, sp. n. ✓
	More robust species, with ground-colour entirely yellow (♀). Wing strongly dilated (♂), fifth posterior cell well infuscated	8.	*apicalis*, sp. n. ✓
11.	Thorax yellow, with two prominent, widely separated, black stripes	1.	*sundaica* Jaenn. ✓
	Thorax either entirely unmarked dorsally or yellowish brown with broad, partially divided, median stripe	12.	
12.	First and second antennal segments black, or at least dusky	13.	
	First antennal segment bright yellow	14.	
13.	A slender species with black bristles in moustache, grey-brown thorax with sharply marked pattern, and indistinct		

black stripes on femora. Wings in males feebly dilated .... 15. *distincta*, sp. n.

More robust species with moustache entirely white, thorax yellower than abdomen, pleura often darker in front, especially in females. Femora without pattern, though sometimes uniformly dusky. Wings strongly dilated in males. 5. *cochinensis*, sp. n.

14. Small species (wing-length 10–15 mm.). Wings in males feebly dilated .... 15.

Larger species (wing-length 15–23 mm.). Wings in males strongly dilated ...... 16.

15. Infuscation hardly extending at all into fifth posterior cell .... 7. *minor*, sp. n.

Infuscation in fifth posterior cell well marked, usually triangular .... 6. *bengalensis* Macq.

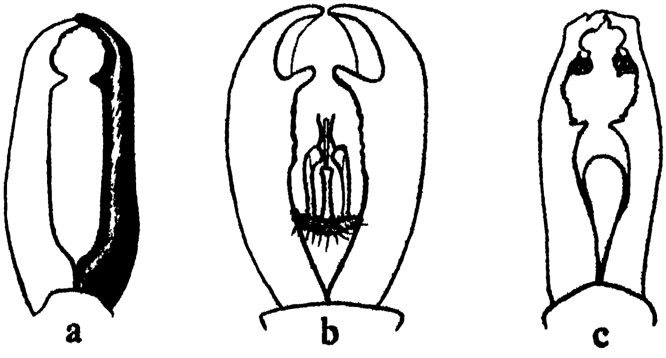
16. Infuscation in fifth posterior cell broad and triangular. Male with conspicuous tuft of yellow hair on eighth sternite .. 4. *cristatus*, sp. n.

Infuscation in fifth posterior cell narrow and confined to margin. No hair-tuft on eighth sternite......... .... 17.

17. Dorsum of thorax pale yellow, without stripes.......... .... 2. *xanthopus* Wied.

Dorsum of thorax dark brown, with a divided median stripe .... 3. *xanthopus* [var. *uulpi*, nov.

Fig. 2.



Dorsal view of terminalia: (*a*) *C. brevipennis*, sp. n.; (*b*) *C. bengalensis* Macq.; (*c*) *C. sundaica* Jaenn.

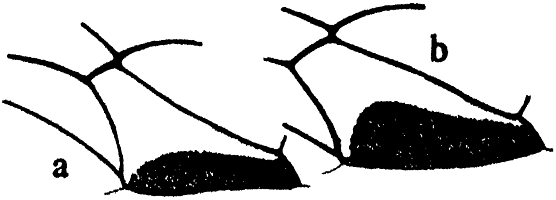
1. *Clephydroneura sundaica* Jaenn. (Fig. 2 *c*.)

1867. *Asilus sundaicus* Jaenn. Abh. Senckenb. naturf. Ges. vi. p. 363.

A very distinct species, readily recognised both by the unique form of the male terminalia and by the appearance of the thorax. The mesoscutum is yellow with two widely separated black stripes following the line of the dorsocentrals, and spreading out behind the humeri into a pair of lateral black areas. In some specimens the black stripes are unusually wide, but the paired appearance in place of the usual broad median stripe is very distinctive. *C. cochinensis*, sp. n., in dark or greasy specimens may have a similar pair of stripes just before the scutellum, but in front they merge in the middle line instead of remaining well separated.

General ground-colour clear yellow. Pronotum dark above. Dorsum of thorax largely bare, but long black hairs on and just in front of scutellum. No strong marginal bristles. Abdomen with lateral dark patches, which in the anterior segments unite into a transverse band. Legs yellow, only knees narrowly black. Wings normal, infuscation extending well into fifth posterior cell.

Fig. 3.



a, b. Variation in shape of infuscated area in fifth posterior cell.

In the British Museum from Siam, Biserat, and Bulsit Besar (*Robinson & Annandale*); N.E. Siam, Nung Phat (*Godfrey*); Burma (*Bingham*); Port Dixon, Malay Peninsula (*Meade-Waldo*).

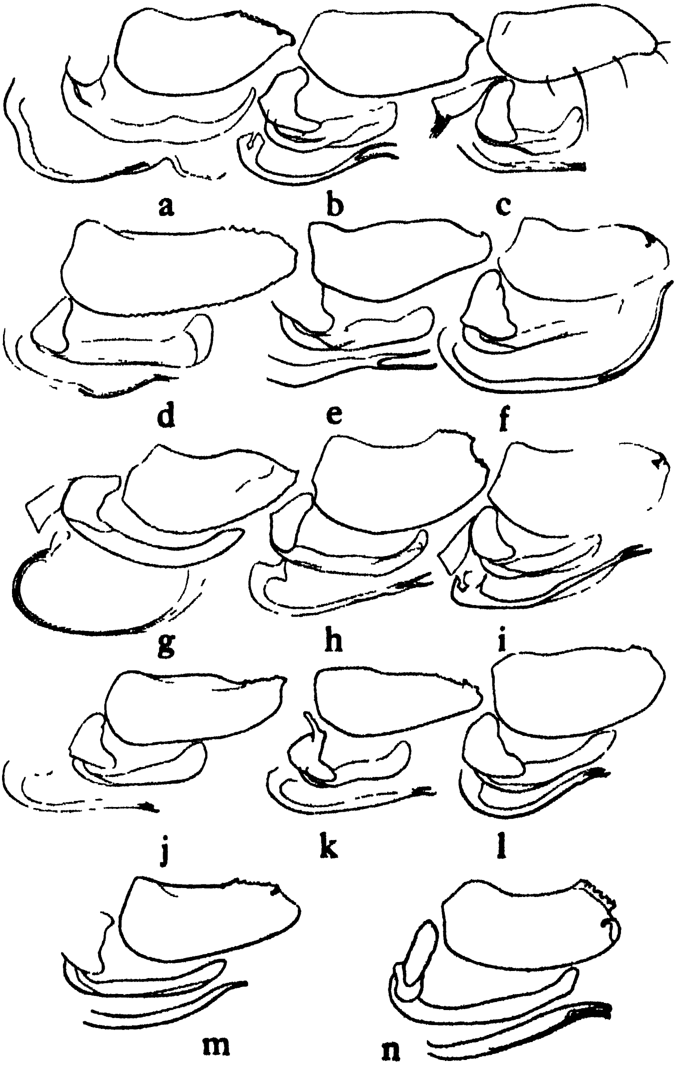
Jaennicke's description, especially his reference to "thorace bivittato . . ." leads me to give his name to this species rather than to *xanthopus* Wied. as suggested by Kertész (1909, p. 283) and Ricardo (1922, p. 58).

2. *Clephydroneura xanthopus* Wied. (Fig. 4 *m.*)

1819. *Asilus xanthopus* Wiedemann, Zoolog. Magaz. i. (3) pp. 5, 6.
1821. *Asilus xanthopus* Wiedemann, Diptera Exotica, p. 186.
1828. *Asilus xanthopus* Wiedemann, Auss. Zweifl. Ins. i. p. 436.

Wiedemann originally (1819) described only the female of this species, characterised by the yellow thorax,

Fig. 4.



Male terminalia of *Clephydroneura* spp.; after boiling in potash, dissecting, and mounting: (*a*) *minor*, sp. n.; (*b*) *pulla*, sp. n.; (*c*) *semirufa*, sp. n.; (*d*) *cochinensis*, sp. n.; (*e*) *cristata*, sp. n.; (*f*) *xanthopus* Wied. var. *wulpi*, nov.; (*g*) *distincta*, sp. n.; (*h*) *exilis*, sp. n.; (*i*) *annulata* Fabr.; (*j*) *flavicornis* Macq.; (*k*) *flavicornis* var. *fusca*, nov.; (*l*) *duvaucelii* Macq.; (*m*) *xanthopus* Wied.; (*n*) *apicalis*, sp. n.

rather browner above, with scarcely a trace of longitudinal stripes; by the antennæ yellow at the base; and by the paired brown abdominal patches which tend to unite into a transverse band on each segment. It was not until 1828 that Wiedemann mentioned both sexes, and here the description exactly matches the earlier ones, with an added sentence describing the form of the dilated wing in the male.

Dr. Beier has kindly allowed me to see the male and female standing in the Vienna Museum as types of this species. The male agrees perfectly with Wiedemann's description, but the female is the darker form described below under the name *wulpi*. This female cannot. therefore, be the subject of Wiedemann's original description, and unless there was an error in stating the sex (which was repeated in 1821) the original type must be missing. It is clear that the typical *xanthopus* is the pale form represented by the male type.

In the Brit. Mus. three males, from Java, Sumatra, and an unknown locality.

Also in the Brit. Mus. three males (Kuala Lumpur, *Durham*; Siam, Biserat, *Robinson & Annandale*; F.M.S., Taiping, *Orme*) and one female (Siam, Biserat, *Robinson & Annandale*), which differ from the above only in having infuscation in the fifth posterior cell.

By the courtesy of M. Collart I have been able to examine the specimen in the Brussels Museum recorded by Wulp (1898, p. 142) as a dark variety of *xanthopus* Wied. This agrees exactly with the female standing as type in the Vienna Museum, and is represented in the British Museum by a series of 13 males and 15 females from Java. The general appearance is very strikingly darker, and since both sexes are represented I propose to name the variety; but since colour-characters are so variable in this genus I hesitate to give it specific rank.

3. *Clephydroneura xanthopa* var. *wulpi*, nov.

(Fig. 3 *f*.)

A robust-looking form, distinguished from *xanthopus* Wied. by its very much darker appearance.

Face white; moustache and beard white. Antennæ yellow, the third segment black or blackish, arista black. Antennal bristles black.

Thorax yellow-dusted, but with dark grey ground-colour, which gives a much darker effect than in *xanthopus*. Bristles normal for genus, longer in posterior part of thorax. Scutellum without marginal bristles.

Abdomen coloured like thorax, all hairs and bristles except a pair on first segment being yellow. Upper forceps of male shining black, rest of hypopygium usually reddish. No conspicuous hair-tuft on eighth sternite.

Legs, including tarsi, yellow; middle and hind knees narrowly black. Bristles mainly yellow on fore legs, black on others.

Type male, Nglirip, Central Java, c. 300 ft.

Nine male paratypes from Java (Soekaboemi and Nglirip, collectors unknown). Two male paratypes in the Brussels Museum from Java (*Fruhstorfer*) and W. Sumatra (*van Lansberg*). The former is one of the specimens seen by van der Wulp.

A number of females of this variety have been seen, but they are very difficult to distinguish from those of the following species.

4. *Clephydroneura cristata*, sp. n. (Fig. 4 *e*.)

Readily distinguished in the male from the foregoing form by the conspicuous tuft of yellow hairs and bristles borne by the downturned eighth sternite, and even more strikingly by the form of the ædeagus (figs. 3 *e*, 3 *f*). Otherwise there is practically no difference between them, beyond a tendency for the infuscation of the wing-tip to extend more fully into the fifth posterior cell, forming a triangular area. This is useful as a rough guide, but is variable and not at all reliable.

Type male, Java (Soekaboemi), iii. 1926. Eleven male paratypes from Java (Soekaboemi, iii. 26; Mt. Ardjoeno, 6000 ft., i. 36; collectors unknown).

I have also seen over fifty females belonging to this or the previous species, but cannot separate the two with any degree of certainty.

5. *Clephydroneura cochinensis*, sp. n. (Fig. 4 *d*.)

A series of five males and thirteen females in the Brussels Museum, and one pair in the British Museum, from Cochin China and French Indo-China.

This species has the male terminalia in the dried state somewhat resembling those of *C. vulpi*, but readily distinguished on dissection. The males and typical females are conspicuous by having the thorax much lighter in colour than the abdomen, but there is considerable variation in the females, in which the pleura are often of dark ground-colour in front, forming a triangular area, the tip of which includes half of the middle coxa.

♂. *Face* with white or yellowish tomentum over a dark ground, vertex and occiput similar. A few white hairs on each side above antennæ, about six short dark hairs on ocellar tubercule, occipital hairs white, with a few black bristles near the centre.

Antennæ a dark mahogany-brown, almost black, the joints lighter and reddish. Grey dusting especially noticeable on first segment. Prominent hairs all black. Moustache and beard white. Proboscis and palpi an oily black, with pale yellow hairs.

Thorax with both dorsum and pleura yellow, with yellow tomentum, a bare stripe in the middle appearing darker, especially at its edges. Yellow hairs on the meta- and hypopleura, on metanotum, and weakly on sternopleuron and in front of mesopleuron. Dorsal bristles black: two presutural, one supra-alar, one strong and one weak postalar; dorsocentrals extending well in front of suture, and, weakly, nearly to fore margin of thorax. Centre of dorsum behind suture, and scutellum, uniformly covered with short black bristles. Marginal scutellars very weak and numerous.

Halteres entirely yellow. Squamal hairs yellow, a few black hairs on axillary callosity.

Abdomen with basal segments yellow at sides and margins, black in middle. Posterior segments with increasingly more black.

Legs yellow, with tips of middle and hind femora black. Front tarsi yellow, last two segments rather darker; middle tarsi more dusky; hind tarsi and tip of tibiæ blackish. Bristles mainly black, but one or two long brown bristles on basal half of fore tibia. Fore femora below with a long yellow fringe.

Wings normally dilated on fore border. Infuscation in fifth posterior cell greater than in *vulpi*.

♀. Differs from male in yellower head-pubescence; distinctly darker thorax (which is very variable and may be largely black, especially in greasy specimens); and in having long black bristles below the anterior femora. The legs too may be darkened or reddened, and the third antennal segment may be quite pale; but the first is always dusky.

Type male, P. Condoza, 7. vii. 24.

Allotype female, P. Condoza, 11. viii. 24.

Paratype male, 2 Phuquoc, 9. ix. 24, 31. viii. 24; 2 Thiagnuyen, 21. vii. 23.

Paratype females, 6 Tayninh, 15. x. 23–20. xii. 23; 1 Thaignuyen, 23. vii. 23; 1 Phuquoc, 18. ix. 24.

All the above collected by R. Vitalis de Salvaza, and deposited in the Brussels Museum.

3 Kuala Lumpur, nr. Lake Garden, 12, 19. ix. 34; 1 Selangor, Uln Langat, 1. ix. 34, and 2 same locality, 29. viii. 34; 1 Upper Perak, Lenggon, 22. x.–5. xi. 34; 1 Kedah Peak, 3000 ft., xii. 1915; 1 Kuala Lumpur, 23. i. 28.

The above in the Selangor Museum, Kuala Lumpur.

Five males—Kuala Kangson (*Hanitsch*), Kuala Lumpur (*Pendlebury*), Port Dixon (*Meade-Waldo*), Laos: Giranville (*Vitalis*), and Cochin China, Tayninh (*Vitalis*)—have the thorax as dark as the abdomen, and the pleura darkened as in the females. They may represent a variety, though the genitalia are indistinguishable from the typical form. The above in the British Museum.

The Brussels Museum has kindly presented to the British Museum a pair of paratypes of this species—Thaignuyen and Tayninh—and a male of the darker form from Tayninh.

6. *Clephydroneura bengalensis* Macq. (Fig. 2 *b*.)

1839. *Asilus bengalensis* Macquart, Mém. Soc. R. Sci. Lille, 1838 (3), p. 257; and Dipt. Exot. i. (2) p. 141.

In appearance very similar to *C. minor*, sp. n., from which it differs in the form of the male hypopygium, and in having a larger area of clouding in the fifth posterior cell. The short bulbous hypopygium is very characteristic. The wings of the male are hardly dilated.

Although the species, as its name implies, was originally described as from Bengal, it has never since been recorded there, but Wulp, de Meijere, and Frey have recorded it from Java. Macquart's description, including a mention of the weakly dilated wing, could only apply to this species or to *C. minor*, sp. n., and his figure of the genitalia shows an ædeagus exactly agreeing with the present species. It is probable that the locality was given in error as in the case of other Diptera from the Fruhstorfer collection.

In the British Museum, 23 males and 39 females from Java, Soekaboemi, 1 female from W. Java, Preangar, Djampang, Tenggah, 2 females from Sumbawa or Sepanjang Is.

In the Brussels Museum, 2 females from Java (*Fruhstorfer*).

7. *Clephydroneura minor*, sp. n. (Figs. 1 & 4 *a*.)

A small yellowish-grey species, rather resembling small specimens of *C. xanthopus* Wied. The male is easily recognised by the unusually long trifid penis, and by the upper forceps, which are partly red and partly black.

♂. *Face*, frons and occiput all white-covered. Occipital hairs and bristles white. One or two short black bristles on the ocellar tubercule. Moustache white. Antennæ yellow, third segment rather dusky, arista black. All the prominent antennal hairs black except a tuft of tiny pale hairs on the third segment just above the base. Palpi brown with pale yellow hairs.

Thorax with yellow tomentum, but the ground-colour is black, giving the whole a greyish appearance, especially in the broad middle strip. Humeri yellow. Scutellum yellow with discal black hairs and numerous weak marginals, up to six of these in the middle being prominent.

Abdomen with hairs entirely yellow, segments grey dorsally and basally.

Legs almost entirely yellow, hind knees only being very narrowly black, and tarsal segments somewhat dusky. Hind legs with black bristles in front, otherwise hairs and bristles mainly yellow.

Wings with costal border much less dilated than is normally the case in this genus.

Type male, Khasi Hills, Assam (*A. Chennell*, 1878).

Three male paratypes have much less black on the upper forceps than the type, and have black bristles on the middle femora. Also one female paratype, all from Burma (*E. Y. Watson*).

8. *Clephydroneura apicalis*, sp. n. (Fig. 4 *n*.)

A largish, pale yellow species, greyish dorsally, with the legs mainly yellow, but with broad black tips to the middle and hind femora. In this it resembles both *C. annulata* Fabr. and *C. exilis*, sp. n., from both of which it can be distinguished by the larger extent of infuscation in the fifth posterior cell.

Face and frons, including ocellar tubercule, uniformly covered with yellowish tomentum. Occiput similar, with white bristles and hairs. Ocellar bristles pale. Moustache entirely white. Antennæ yellow, first two segments with black hairs, and first segment at base with a few white hairs below. Third antennal segment darker, arista almost black. Proboscis dark brown, palpi brown with long yellow hairs.

Dorsum of thorax brown with yellow margins and suture, median brown stripe divided by a yellow strip. Bristles black: two presutural, several supra-alar, two to four being prominent; one very prominent postalar and one weaker, with several very weak ones. Numerous small black bristles along the dorsal stripes, becoming stronger and more numerous behind. Scutellum yellow, with fine black bristles on the disc and edge, but no strong marginals. Pleura yellow, metapleura, hypopleura, and squamæ with yellow hairs. Coxæ yellow, with yellow hairs. Halteres entirely yellow.

Abdomen brownish yellow above, without special markings, but with numerous yellow hairs, which become longer and more bristly towards sides.

Legs almost entirely clear yellow, tarsi included. Middle femora black for apical fifth, without a clear area at tip as in annulata. Hind femora similarly marked, tips of tibiæ and of tarsal segments faintly dusky. All legs covered with fine black bristles and with long yellow hairs, especially below. Most of prominent bristles black, but two upper tibial bristles and some of the tarsal bristles on the fore legs yellow.

Type male, Naraikkadu, Tinnevelly Dt., S. India, 2500–3000 ft., 9. iii. 36 (*B.M.-C.M. Exped.*).

What is probably the female of this species was described by Ricardo (1919, p. 65) as the female type of a new species, *Neoitamus pulcher*. The specimen from Kandy, Ceylon, 20. v. 92 (*Lt.-Col. Yerbury*), is in reality a female with a short downturned ovipositor, and is probably a *Cinadus*. Since this is the first specimen recorded by the author, we may take it as type of *N. pulcher* Ric. The other two females-- Harayam, Ceylon, 1. vi. 92; Kandy, Ceylon, 20. v. 92 (*Lt.-Col. Yerbury*)--have a long compressed eighth segment, and belong to the present genus. The dorsum of the seventh segment is also bare and shining, though the margins are yellow-dusted (cf. *gymnura*, sp. n.). The leg-markings are identical with those of the male type of *apicalis*, but the thorax is black dorsally and on the fore half of the pleura.

9. *Clephydroneura annulata* Fabr. (Fig. 4 *i*.)

1775. *Asilus annulatus* Fabr. Syst. Entomol. p. 794.
1849. *Asilus barium* Wlk. List. Dipt. Brit. Mus. ii. p. 426.

First and second antennal segments yellow, with black hair; third dusky, of medium length. No black hairs on frons. Several occipital bristles black.

Thorax black in ground-colour, only thinly covered with tomentum. Pronotum uniformly blackish. Mesonotum with yellow tomentum, a broad, indistinctly divided, dark brown central stripe, and rather lighter brown side-spots. Scutellum blackish, with very short black discal bristles and two weak marginals. Pleura and metanotum blackish thickly covered with greyish tomentum, with white hairs and weak metapleural bristles. Coxæ similar.

Abdomen with yellowish-grey tomentum and central and lateral rows of brown spots. Clothing hairs all whitish.

Legs reddish yellow, except for black hind trochanters, tips of hind tibiæ, all tarsal segments, and a black area at tip of upper surface of all femora. On fore femora, and in some specimens on all femora, this spot is just before tip and gives appearance of a black ring.

Wings infuscated at tip, but hardly at all in fifth posterior cell. Wing-membrane stained yellowish. The principal cross-veins and forks usually have more or less distinct brown spots.

In the British Museum 19 specimens from Ceylon. Localities: Kanthalia, Trincomali, Kandy, Galbodde, Udagama, Mount Lavinia, Pundaluoya, Colombo, Pankullam, Sigiriya. One female from S. India, Coimbatore, was recorded by Ricardo (1922, p. 60) as *bengalensis* Macq.

10. *Clephydroneura duvaucelii* Macq. (Fig. 4 *l*.)

1839. *Asilus duvaucelii* Macq. Mém. Soc. R. Sci. Lille, 1838 (3), p. 257, and Dipt. Exot. i. (2), p. 141.

Antennæ yellow, with hairs mainly yellow. Occipital bristles all yellow. Thorax with ground-colour yellow, but rather a pink appearance in dorsal aspect. Usual dorsal stripes and prominent short black hairs all over mesonotum. Scutellum with longish white hairs on disc and two black marginal bristles. Metanotal and pleural hairs white.

Legs mainly yellow. Femora black above, except at base: on middle and hind femora this colour extends into a subapical ring. Tibiæ all black-tipped, and tarsi black except at base.

Abdomen with narrow central spots very distinct; bristles and hairs all white.

Wings entirely hyaline, only weakly dilated.

In Brit. Mus. two males "India"; two females Jubbulpore, N.W. India (*C. G. Nurse*; *E. A. Brunetti*); one female Alagar Kovil, Madura Dt., S. India, 17. iii. 36 (*B.M.-C.M. Exped.*).

A male in the Oxford Museum has leg-markings much paler, indeed almost absent on fore and middle legs, and the upper forceps appear slightly more slender. When more specimens are available this may prove to represent a distinct species.

11. *Clephydroneura flavicornis* Macq. (Fig. 4 *j*.)

1839. *Asilus flavicornis* Macq. Mém. Soc. R. Sci. Lille, 1838 (3), p. 258 and Dipt. Exot. i. (2) p. 142.
1849. *Asilus iamenus* Walk. List Dipt. Brit. Mus. ii. p. 428.

Third antennal segment slightly elongate. First two segments and base of third yellow. Antennal hairs black. Occipital bristles variable, being sometimes all white, sometimes mixed black and white.

Legs yellow, femora black above and in front; hind femora more extensively black, especially in Walker's type. Tips of tibiæ and of tarsal segments black, and whole of hind tarsi black. Otherwise very similar to *annulata* Fabr.

Wulp (1898, p. 142) placed *flavicornis* Macq. as a synonym of *annulatus* Fabr. (=*barium* Walk.), but I think the leg-markings justify its identification with Walker's other species. The type-localities also agree, whereas *barium* Walk. is a Ceylon species.

Besides the difference in the upper forceps (fig. 4), this species is usually to be distinguished from *duvaucelii* Macq. by the more definite femoral stripes and by the general coloration, but there is an atypical male in the Oxford Museum which can scarcely be distinguished from *duvaucelii* except by the form of the terminalia.

In the British Museum: Walker's type (♂) from Bengal; two males, two females from Dehla Dun; one male, one female, " India."

12. *Clephydroneura flavicornis* var. *fusca*, nov. (Fig. 4 *k*.)

Distinguished from the typical form of *flavicornis* only by the more uniformly dark femora and the more prominent black bristles on the occiput and metanotum. The male terminalia show a slight difference, but I do not think this is of specific value.

Type male, Top Slip Camp, Nelliampathi Hills, 26. iv. 37.

Paratypes, male, one from same locality as type; one each from Dhimbam, Biligirirayan Hills, 28. iv. 37; Sethumadi, 20 km. S.W. of Pallachi, 25. iv. 37; and Thekkadi, Periyar Dam, Travancore, 6–10. v. 37 (all *B.M.-C.M. Exped.*).

One female which may belong here, from Jubbulpore, N.W. India, vii. 1909 (*C. G. Nurse*).

13. *Clephydroneura semirufa*, sp. n. (Fig. 4 *c*.)

A medium-sized black and white species, with legs particoloured red and black. Closely allied to *C. flavicornis* Macq., from which it is distinguished by the slightly smaller size, by the fore and middle legs being less considerably red, and the hind tibiæ and tarsi being completely black. There is also a difference in the shape of the upper forceps of the male.

Face with white tomentum, rather brownish towards middle. Moustache entirely white. Tomentum of frons brown in an oval patch between ocellar tubercule and bases of antennæ otherwise whitish. Immediately above antennæ a transverse rectangular depression, while down each side of antennæ is a short row of stiff black hairs.

Occiput grey-covered; postocular bristles four or five on each side, mostly black, though one or two may be white. Below bristles hairs silvery white.

Antennæ completely black, with black hairs especially noticeable below the first segment. Proboscis and palpi black with white hairs. A tuft of white hairs below the proboscis on its basal half.

Thorax brown, margins and suture outlined in grey. Median brown stripe indistinctly divided over its full length. A small black triangle with its base on the scutellar suture, its apex forward. Scutellum grey-covered.

Numerous small black bristles along central stripe and side-margins, with large bare areas before and behind the transverse suture. Prominent bristles strong and black:—Two presutural; a row of supra-alars of varying size, three or four of which are prominent; one or two prominent postalars, along with several smaller ones. All bristles longer towards back of thorax, and on disc of scutellum. Scutellum with two long black marginals, widely separated.

Pleura grey-covered. Pro- and hypopleura with silvery hairs and metapleura with silvery hairs and three black bristles. Coxæ all grey, white-haired. Squamæ and metanotal callosities with white hairs. Halteres yellow, greyish at tips.

Abdomen dorsally a warm brown, bases of second and third segments ashy. All posterior margins white, though more narrowly in posterior segments. Along the front of each white band is a row of white hairs ending in one or two white bristles on each side; except the first segment, which has a pair of long black bristles on each side. Venter similar, with long white hairs.

Legs: trochanters all black. *Fore legs* with femora red with wide black stripe in front and above; tibiæ reddish, rather darker in front; tarsus black. Fore femora bare of bristles, fringed below with long white hairs; tibia and tarsus with black bristles in front, white behind, all with long white hair. *Middle legs* similar, but with proportionately more black. Femora with one or two black bristles in front. *Hind legs* with femora black except for a basal ring and an obscure area behind, which are red. Tibiæ and tarsi entirely black, though with thick yellow hairs behind towards the tip. Also long silvery hairs and numerous bristles which are mainly white.

Wing normally distended, smoky area at tip including outer margin of fifth posterior cell.

Body-length 18 mm. Length of one wing 12 mm.

♀ similar, face more yellow, ovipositor not including seventh segment, shining brown with black hairs as well as white.

Types ♂♀ and 5 ♂♂ and 3 ♀♀ paratypes, all from Kodaikanal, S. India, 7000 ft., 24. iii. 36; ♀ paratype from Madukarai, Coimbatore Dt., S. India, 19. iv. 37 (all *B.M.-C.M. Exped.*).

14. *Clephydroneura pulla*, sp. n. (Fig. 4 *b*.)

Very closely similar to *C. semirufa*, sp. n., but sharply distinguished in having the legs almost entirely dark coloured. Femora uniformly dark purple-black, tibiæ more brown, and lighter towards base. Leg-bristles mainly black, legs with numerous long silky-white hairs. Central stripe of thorax is more distinctly divided into two parts, which in front are well separated by a yellow area.

Type male and one paratype male, Vizagapatam, S. India, 3–9. vii. 26 (*R. Senior-White*).

15. *Clephydroneura distincta*, sp. n. (Fig. 4 *g*.)

A very slender, *Ommatius*-like species, dark grey-brown with yellow legs, the femora with an indistinctly darkened stripe. Male unique in genus in having a long whip-like ædeagus.

Antennæ black, with long third segment. Facial tubercle very small, moustache with one or two black hairs above.

Face with white tomentum, moustache mainly white, with a few black hairs above. Frons with lateral black hairs. Some of the occipital bristles black.

Pronotum grey, with white hairs and bristles. Dorsum of mesothorax yellowish brown, with two well-defined dark brown stripes lying between acrosticals and dorsocentrals, and two lateral dark areas on each side. Dorsocentrals and paired acrosticals well defined, and extending very nearly to front of mesothorax. A few bristly hairs above and behind humeri, and round side-margins the usual bristles, but rest of dorsum quite bare. Scutellum with longish white hairs on disk and margins. Pleura thickly covered with yellowish-grey tomentum; white hairs on hind margin of mesopleuron and on sternopleuron, white bristles and hairs on metapleuron, hypopleuron, and metanotum. Halteres yellow, dusky-tipped.

Abdomen dark grey, with yellow tomentum and yellowish apical bands to each segment, in front of which are numerous long fine bristles. All hairs and bristles yellow or whitish.

Legs yellow, fore femora above and middle femora in front with short indistinct black stripe; hind femora faintly dusky, but no distinct markings. Tibiæ and most of first tarsal segments reddish yellow, rest of tarsi black.

Wing-margin scarcely dilated in male, and discal cell not very strongly constricted. Wing-tip infuscated, this area extending well into fifth posterior cell; rest of wing-membrane hyaline.

Type male, Coonoor, 6000 ft., S. India, 22–23. iv. 37 (*B.M.-C.M. Exped.*).

16. *Clephydroneura exilis*, sp. n. (Fig. 4 *h*.)

Like *distincta*, above, a rather slender *Ommatius*-like species.

Antennæ yellow, with black hairs, third segment dusky. Frontal hairs and occipital bristles white.

Pronotum and mesoscutum, and a triangular area including most of mesopleuron, half of sternopleuron and base of middle coxa, black. Rest of pleura yellow, with white hairs on sternopleuron and metapleuron, white bristles on metapleuron and hypopleuron. Metanotal bristles mixed black and white. Scutellum reddish yellow, with black discal hairs, no prominent marginal bristles.

Abdomen with white hairs and bristles only. Pattern destroyed by rubbing in single specimen ; ground-colour black, with red lateral margins and apical bands.

Legs all reddish yellow, with only tips of middle and hind femora black. Tarsal segments brown-tipped. Wings strongly infuscated, band in fifth posterior cell broad, but not sharply angled.

Male hypopygium resembles that of *C. pulla*, sp. n., but can be distinguished on dissection.

Type male, Burliyar, 3000 ft., Coonoor Ghaut, S. India, 17. iv. 37 (*B.M.-C.M. Exped.*).

I have seen a female [Kuala Lumpur, nr. Lake Garden, 21. ix. 34 (*Pendlebury*)], which runs down in the key to this species, but differs in having no black on the pleura, but a black scutellum. The hind femora also have an indistinct stripe. In view of the widely separated localities, I think this is likely to be a related species rather than the female of *exilis*.

17. *Clephydroneura brevipennis*, sp. n. (Fig. 2 *a*.)

A rather slender, dark species, with the wings distinctly shorter than the body, reaching only to the tip of the sixth segment in the male.

♂. First two antennal segments yellow, third dusky. Frontal hairs white, occipital bristles black.

[Thorax and abdomen very greasy, pattern being destroyed.]

Thorax, ground-colour black on pronotum, mesonotum (except humeri and postalar callosities), most of meso- and sternopleura, and lower part of hypopleura. Scutellum red, with black discal hairs, and two black marginal bristles. Metanotum red at sides, with a black central area. Pleural and metanotal hairs all white, with no strong bristles.

Abdomen ground-colour black, with only margins reddish. Except for a single black bristle at each side of first segment, all hairs and bristles are white.

Legs, femora reddish yellow, indistinctly black above and in front. Tibiæ and first tarsal segments yellow, black-tipped, rest black.

Wings strongly dilated, clear, but stained with yellow.

♀. Agrees with male, except in having two strong black bristles in moustache, some of frontal bristles black, four black bristles on pronotum, and discal and prominent segmental bristles on abdomen black.

Type male, Top Slip Camp, Nelliampathi Hills, S. India, 26. iv. 37.

Type female, Thekkadi, Periyar Dam, Travancore, S. India, 6–10. v. 37.

Both *B.M.-C.M. Exped.*

18. *Clephydroneura gymnura*, sp. n.

Nearly related to *C. brevipennis*, sp. n., from which it is easily distinguished by having the discs of the seventh abdominal segment in the female, and the seventh and eighth in the male, bare and shining. I have only seen this in one other species of *Clephydroneura*, in two females which I referred to *apicalis*, sp. n. The upper forceps of the male resemble those of *brevipennis*, sp. n., but each half is not so strongly cylindrical in cross-section.

♂. First two antennal segments yellow, with black hairs; first segment also with long pale hairs below. Moustache and occipital and pronotal hairs and bristles entirely white.

Thorax: dorsum and pleura dark in ground-colour, with dense tomentum. Median brown stripe divided, and black at edges in front.

Abdomen on each segment a very narrow central brown spot and a pair of lateral longitudinal stripes placed very near to the side-margins. Seventh and eighth segments bare, shining brown dorsally, with sides and hind margins dusted. Hairs and bristles entirely white.

Legs yellowish red, middle and hind femora with anterodorsal black spot extending anteriorly into a short black stripe. Tibiæ and first tarsal segments with black tips, rest of tarsi black.

Wings strongly dilated, without infuscation, but stained yellowish in front.

♀. Exactly similar, except for black bristles below fore femora and only one bare segment before terminalia.

Type male: the only male known to me is a specimen without locality, in the Oxford Museum.

Allotype female, Khangpur, Central India, 25. ix. 07 (*Brunetti*), in the British Museum.

Paratypes: two females " E. India " (Saunders Coll.), in the Oxford Museum.

19. *Clephydroneura* sp. indet.

Three females from the Biligirirayan Hills, S. India (*B.M.-C.M. Exped.*).

Well characterised, but in the absence of the male I do not propose to give them a name.

Antennæ black, but third segment not so long as in *semirufa* or *pulla*. Legs resembling those of *semirufa*, but femora more extensively black, especially the two hind pairs. Tibiæ pale yellow, black-tipped. Moustache with some black hairs above. Pleura with very heavy tomentum, but clearly darker in front half. Abdomen black with grey tomentum and indistinct brown centre stripe. Wings infuscated, but the infuscated area hardly extending into the fifth posterior cell.

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LIII.—*A new Race of the Sand-Cat* (Felis margarita). By R. I. POCOCK, F.R.S. (Zoological Department, Natural History Museum).

IN their report upon the mammals collected by Angus Buchanan in the south-western Soudan, mostly at Aïr, Thomas and Hinton (Ann. & Mag. Nat. Hist. (9) xvi. p. 188 (1925)) referred to a specimen of *F. margarita* which was sent to the late Lord Rothschild, who intended to write an account of it, but apparently did not do so. This specimen was seen by Lavauden (Bull. Soc. Hist. Nat. Afr. Nord, xix. p. 258 (1928)) and by Flower (Proc. Zool. Soc. 1932, p. 390), both of whom adopted that name for it, as recorded in my paper on this cat long due to be published by the Zoological Society. In this paper I described as apparently representing a new race a specimen collected by Col. R. Meinertzhagen and Mr. Willoughby Lowe at El Golea in the Algerian Sahara, naming it *F. margarita meinertzhageni*.

Since the locality in the Soudan where Angus Buchanan collected is about 1000 miles to the south of the type-locality of Meinertzhagen's Sand-Cat, it seemed likely that the two specimens would prove to be racially distinct. I therefore wrote to Dr. Jordan, F.R.S., asking for the loan of the skin and skull for examination, and he kindly granted my request. The expectation that Buchanan's specimen would represent another race of this rare and interesting species proves to be correct. I propose therefore to describe it as follows :—

Felis margarita aïrensis, subsp. n.

Type. Ad. ♀ from In-Abbangarit, W. of Aïr, S.W. Sudan, 850–1000 ft. (*Angus Buchanan*).

Coat soft but not long or luxuriant, the hairs on the upper flank about 25 mm., underwool moderate in amount. Colour : face white, with a faint buffish patch between the eye and the rhinarium and a deeper buff stripe extending from the posterior corner of the eye beneath the ear ; crown of the head sandy-buff, with a faint buffy white or grey speckle, and with a tolerably well-defined pattern of six stripes formed of elongated, lineally arranged spots and extending from the forehead, where they are buffy, on to the fore nape, where, as between the ears, they are fuscous; ears mostly buff, without the grey speckle of the crown, with a tolerably large blackish apical spot, about 15 mm. long; nape and shoulders with the pattern traceable but not so distinct as on the crown; back from the shoulders to the croup greyish sandy owing to an extensive subapical whitish-buff band and a small black tip on the contour hairs; the black very much in evidence in the middle of the hind back, where it forms two longitudinal stripes, running along the spinal crest to the root of the tail; sides of body paler, with less black than the back, but ornamented with five or six distinct vertical buff stripes; under hair of the mid-line of the back rich ochreous buff, paler buff laterally and white on the sides; tail above like the back, indistinctly striped with black, but the distal third whiter, with a subdivided black tip and a blackish stripe in front of it; lower side of tail mostly white, with some very faint buff traces of stripes; hind leg with thigh marked externally with about five more or less infuscate stripes, the two nearer the hock strong but not extending on to the inner side of the thigh, which is clean white, turning to rich ochreous posteriorly, area below the hock white except the hairs about the pads, which are brown-grey, and a buffy patch on the outer side just above the plantar pad. Fore leg rather rich ochreous buff above turning to white on the paws, two strong dark brown stripes, joined or nearly so behind by a large patch of the same colour, the upper imperfectly, the lower completely encircling the limb; the hairs on the soles brownish grey, a small black patch on the outer side above the plantar pad. The whole of the underside of the body from the chin to the inguinal region clean white with no pattern.

The hair-mats on the feet much less developed than in other races of the species, the pads more exposed, and only the posterior part of the plantar pad covered.

The flesh-measurements in English inches, with those of the type of *meinertzhageni* for comparison, are as follows :—

meinertzhageni ..	♂ head and body 18; tail 11; hind foor 4⅛; ear 2⅜.
aïrensis.........	♀ head and body 15⅜; tail 9⅛; hind foot 4; ear 2.

The following are the principal skull-measurements of the two :—

	Cond.-bas. length.	Zygom. width.	Across postorb. processes.	Max. width.	Bulla.	med. lg.	$Pm.^4$.	*m.*
meinertzhageni, ♂	84	70	53	24	24×16	24	10+	7
aïrensis, ♀	77	62	46	19	23×15	23	10	7

The differences in size both bodily and cranial between the two specimens are probably a matter of sex. The skull of *aïrensis* is in all essentials like that of *meinertzhageni*, both being distinguished from skulls of *F. ocreata* by the large bullæ, long nasals, and absence of thickening outside the infraorbital foramen on the malar. The large size of the bullæ in *F. margarita* is probably an adaptation to desert life. They recall the inflated bullæ of the Fennec Fox (*Vulpes zerda*), which has a similar habitat; but in the Fennec the pinna is also greatly expanded. This is not the case in *F. margarita*, in which the ears themselves are not appreciably longer than in *F. ocreata*.

Apart from size this specimen differs from the type of *meinertzhageni* in the following particulars :—(1) The winter coat is much shorter and less luxuriant, although the two were collected in the same month, namely February. This suggests that the cold of winter is much more severe at El Golea than at Aïr. Also the mats of hair on the soles of the feet are correspondingly shorter and less bushy, hardly overlapping the toes in front and not entirely covering the plantar pad behind. (2) The general colour is much lighter owing to there being noticeably less black speckling in the contour hairs of the dorsal surface; the underhair of the spinal area is rich ochreous buff, not sooty; the face is much whiter owing to the smaller and paler buff patch on the muzzle between the eye and nose; the ears behind are bright buff throughout except for the fuscous patch at the tip, which is much smaller than in *meinertzhageni*; the crown, nape, and shoulders are also more yellowish buff and the crown has six tolerably well-defined rows of long spots, forming stripes, which are traceable over the nape and shoulders; the spinal area of the hind back has two black longitudinal stripes, and the vertical stripes on the flanks are more distinct and buffy; the underside from the throat backwards is clean white, not tinged with buff; the large black patch on the sole of the hind foot close to the plantar pad in *meinertzhageni* is represented by a buffy spot, and the stripes on the fore legs are less well developed.

So far as I can judge from the descriptions of a few skins identified as typical *margarita*, namely the original specimen from Négousa described and figured by Loche (Rev. Mag. Zool. x. p. 49, 1858), one from Fort Poliquac described by Lavauden, and one from Laghouat described by Heptner and Dementiev (Bourdelle's 'Mammalia,' i. no. 6, p. 228, 1937), this new race is more like the typical form than it is like *meinertzhageni*. But it is at least distinguished by the comparatively poor development of the hair-mats on the soles of the feet, which do not fit Loche's description as being clothed "*more leporum.*" It also differs apparently in the presence of the stripes on the crown and on the spinal area of the hind back. Heptner and Dementiev indeed stated that in their specimen spots and stripes were almost entirely wanting and that the stripes on the haunches were few and feebly marked. This is certainly not true of Buchanan's specimen; nor is it true of the type, judging from Loche's description and figure.

According to a note by Buchanan this cat lives in holes in the sand-dunes in Aïr. The specimen was captured by being dug out of a hole in which it had taken shelter. The type of *margarita* was recorded as killed in a very dry, sandy locality with scattered clumps of plants at Négousa on the Tripoli limit of the Algerian Sahara; and the district of El Golea, where the type of *meinertzhageni* was procured, consisted, Mr. Willoughby Lowe told me, mainly of sand and rocks. The habitat of the three cats is therefore very similar.

Buchanan's collection also contained specimens of a cat described by Thomas and Hinton as *Felis haussa*. They represent a local race of the common North African wild cat, *F. ocreata*, and were secured at the following localities: Teh Siderak in Aïr, 2350 ft.; Farniso, N. Kano, Nigeria, 1700 ft.; and Zinder in French W. Africa, 1500 ft. These specimens are not all alike, but on the whole the coloration of the dorsal surface is very like that of the type of *F. margarita*. They differ from it principally by the comparative indistinctness of the stripes below the elbow on the fore leg and above the hock on the hind leg, the more conspicuous stripes on the end of the tail, the presence of two buff stripes across the throat and of numerous buff spots on the belly, the darker tint of the paws and face, the face having two cheek-stripes, and the deeper, more ochreous hue of the ears, which are more sharply contrasted with the crown, have no dark tip, but are furnished with a short apical pencil of hairs of which no trace is visible in the types either of *meinertzhageni* or *aïrensis*.

The close kinship between *F. margarita* and *F. ocreata* is shown by the presence of the spinal crest, the general pattern, the ochreous underhair of the dorsal surface, and the shape of the skull. The example, moreover, collected by Buchanan, has the hair-mats on the soles, which were regarded as distinctive of the species, much less developed than in the type of *margarita*, and the coat is not appreciably softer and more silky than in examples of *F. ocreata haussa*.

LIV.—*Studies on the Onychophora.*—V. *Onychophora found in Cape Colony.* By S. M. Manton, M.A., Sc.D. (Mrs. J. P. Harding), Fellow of Girton College.

[Plate XIII.]

The observations recorded below were made in the course of a visit to Cape Colony in 1933, undertaken with assistance from the Government Grant Committee of the Royal Society, to obtain material for anatomical and other studies, the results of which are being published elsewhere.

Peripatopsis is a genus widespread through the forested and damp areas of Cape Colony, but its abundance in suitable localities is very variable. No precise figures have been obtained, but similar environments may provide a collector with over 100 or with only a very few specimens as a result of a day's search; and the same locality in different seasons or years may show great differences in the abundance of its *Peripatopsis* fauna.

It has been shown (Manton and Ramsay, 1937) that *Peripatopsis* is far less able to control its water loss than other dry-skinned terrestrial creatures, and in consequence it is restricted to environments that are permanently damp throughout all seasons. An exceptionally dry season may exterminate a population locally, and re-colonisation from a distance presents great difficulties if the intervening country is dry, as *Peripatopsis* can only withstand a dry atmosphere for a few hours (Manton and Heatley, 1937). Thus localities presenting apparently suitable conditions for the Onychophora may be devoid of these creatures. Exceptionally wet conditions are also deleterious, as the Onychophora are readily drowned unless they can climb up trees under the bark, or leave the ground in some other way. Discontinuous areas of forest or damp country may thus support isolated colonies Onychophora, and this may be an important factor in the development of local species or varieties.

The local forms of the Onychophora in Cape Colony have not been fully investigated, as collecting over the large areas where they can be found has been very incomplete. Purcell in 1899 recorded six perfectly distinct and five doubtful South African species of *Peripatopsis* from Cape Colony, and in 1900 he considered three of the latter to be specifically identical with *P. moseleyi*. Hutchinson (1928) recorded a new species, *P. intermedia*, from Swellendam, and Lawrence (1931) described the blind white *P. alba* from caves on Table Mountain. Collecting in many small areas during one month's travel across Cape Colony in 1933 yielded at least two other forms which do not fit existing descriptions. These are recorded below, but they are not described fully and no names are given to them as the material is insufficient, most of the specimens having died un-observed at a time when no work could be done on them. Any attempt at interpreting the local forms is better postponed until collections are more extensive and representative.

Peripatopsis balfouri was found on the slopes of Table Mountain. The most profitable places for collecting were the wooded parts known as "Orange Kloof," "Lady Ann Barnard's Cottage," and "Window Gorge." This species was the commonest one on the Cape Peninsula in 1933.

P. capensis was collected on the slopes of Table Mountain, mainly from Orange Kloof and from Kirstenbosch Woods. In 1933 this species was much less common than *P. balfouri*.

P. sedgwicki was collected mainly from Knysna in the main forest about 10 miles along the road from Knysna to Avontuur. Most of these specimens were coloured grey- or reddish-brown, or terra cotta, the latter exactly matching the decaying trunks of wood, in which many were found. Other specimens were obtained in more open country near Grahamstown, and were found mostly under stones etc. A few very large dark grey-brown specimens were collected in woods near the mouth of the Groot River.

P. moseleyi was collected in the forests of the Hog's Back Range near Alice. This was the only locality in which any species could be described as abundant in 1933—many dozens were seen during a few hours' collecting in a very small area. It was noticeable that the land planarians were also numerous, whereas in other forests they had been much more scarce. This may indicate that the continuously damp conditions throughout several years had favoured both *Peripatopsis* and the land planarians. In 1934, after a dry period, the abundance of *Peripatopsis* in this locality had reverted to the usual comparative scarcity.

P. clavigera was not found at Knysna, its previously recorded locality, although extensive search was made.

Opisthopatus cinctipes, previously recorded from Uitenhage and Alexandria, was not found in the former locality.

A form of *Peripatopsis* with sixteen legs was found in the Knysna forests and near Grahamstown. In size it resembled the smaller species forming the *P. balfouri* section of the genus, but it did not curl up spirally as does *P. balfouri* (Purcell, 1900). Most specimens were of a dark grey-black colour dorsally and laterally, and the ventral surface was usually brilliant purple. This pigment is readily soluble in water and spirit. Other specimens were brown with a light lateral band above the legs. The embryos appear to be unlike those of *P. balfouri*. Another form of *Peripatopsis* with seventeen pairs of legs was found in the Wilderness near George. In size it resembled *P. capensis*, but slight differences in its general behaviour and in the external appearance of its embyros suggested that it was distinct from that species.

The recorded variations in colour of the South African species have been summarised by Purcell (1900). All these varieties were found in *P. sedgwicki*, although the terra cotta and dull browns predominated. All specimens of *P. capensis* and *P. balfouri* were of the grey-green to black variety, and all those of *P. moseleyi* were dark grey to black. One large specimen of *P. sedgwicki* showed the colour-variation given in Pl. XIII. fig. 2. It was found in the woods near Van Staaden's Pass between Gamtoos and Uitenhage. The upper surface was almost black, darker than any other specimen I have seen, and it had no trace of the brown colour shown by this species elsewhere. A band of white encircled the head, the antennæ and eyes remaining black, while the oral papillæ and the parts back to the first pair of legs were white. The black dorsal stripe continued across this area. This colour-variety has been recorded for *P. moseleyi* and *P. balfouri* (Purcell, 1900), but does not seem to have been found before in *P. sedgwicki*.

Although a large number of specimens were handled, particular care was taken not to depopulate any region completely, particularly in the neighbourhood of Cape Town. Males and immature specimens were liberated together with large numbers of young ones born in captivity.

It is probable that a scarcity of Onychophora, either locally or in certain years, is seldom due to over-collection, but rather to climatic causes, and to the clearing and burning of land which so easily exterminates whole colonies. Similar observations were made by Steel (1896) for the Australian forms. They are slow-growing animals (as will be shown in the next paper of this series), but their habits give them adequate protection from larger carnivorous organisms, and each female may produce in her lifetime 100 or more young ones, each taking on a free-living existence as adequately equipped as its parents.

Many figures have been published representing the various described species of Onychophora, and many are far from life-like. Two photographs are here given of living animals as they appear on splitting open a decaying log. Pl. XIII. fig. 1 shows two females of *P. moseleyi* and Pl. XIII. fig. 2 represents the colour-variety of *P. sedgwicki* which is described above. I am indebted to Mr. D. P. Wilson for taking the photographs of these animals.

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EXPLANATION OF PLATE XIII.

Fig. 1. *Peripatopsis moseleyi*. Photograph of two living full-grown females (dark grey). About × 1·8.

Fig. 2. *Peripatopsis sedgwicki*. Photograph of living specimen of the colour-variety with a white band round the head, the body being almost black. About × 1·5.

THE
ANNALS AND MAGAZINE
OF
NATURAL HISTORY.

[ELEVENTH SERIES.]

No. 5. MAY 1938.

LV.—*Reptiles and Amphibians from the Southern Hejaz.*

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The interest of the Arabian fauna to zoo-geographers has recently been stressed by Prof. Bodenheimer (1937), and any additional material which may throw light on the complexities of the problem is of the greatest importance. Arabia until recently contained almost the only large terrestrial area which was completely unexplored, and even to-day our knowledge of its fauna is only fragmentary. Consequently the collections made by Col. Philby in the southern part of the Hejaz are of importance, and the following notes on the reptiles and amphibians he obtained may be of interest to students of distributional problems.

The collection contains representatives of twenty-seven species; many of them have not previously been recorded from the Hejaz, and these are indicated in the following lists by an asterisk. Unfortunately, the rough treatment to which the collection was subjected in transit resulted in many of the labels being rendered illegible, so that in many instances precise localities are not available. But the general area collected was between Mecca and

Shabwa (Hadramaut), the eastern foot-hills of the coastal mountains forming the western boundary and the edge of Rub' al Khali the eastern.

A very high proportion of the species and subspecies found in this area (12, or nearly 45 per cent.) are endemic in Arabia, or even in the south-eastern part of that country. Many of these endemic species belong to genera which are Eremian (*i. e.*, restricted to the Sahara-Sind desert belt), e. g., *Uromastyx*, *Scincus*, and *Eryx*, but others are derivatives of African or Indo-African genera, e. g., *Agama*, *Chamæleon*, and *Naja*. *Phrynocephalus*, with one endemic species, is a northern, Irano-Turanian genus, and the other genera (*Leptotyphlops*, *Rana*, and *Bufo*) are almost cosmopolitan. Of the non-endemic species there is a very high proportion of Eremian forms, and, following Bodenheimer's arrangement, they may be grouped as follows :—

(*a*) Paneremian, extending from Morocco-Sahara to Baluchistan and Sind or nearly so far : *Varanus griseus*, *Ptyodactylus hasselquisti*, *Acanthodactylus boskianus asper*, *Spalerosophis diadema*, *Malpolon moilensis*, and *Aspis cerastes*.

(*b*) Eastern Eremian, extending from Sind and Baluchistan to Eastern Arabia, often south to Muscat ; now known further to the south : *Scincus conirostris*, *Ceramodactylus doriæ*.

(*c*) Western Eremian forms living in Egypt, Sinai, S. Palestine, and W. Arabia along the Tihama Plain to Aden, and in the interior to the northern or southern borders of Rub' al Khali : *Tarbophis guentheri* and *Echis coloratus*.

Of the remainder *Coluber rhodorhachis* is Eremian with a range about equivalent to *b* plus *c*, *Mabuya brevicollis* and *Bufo regularis* are Ethiopian, and *Rana ridibunda* and *Hyla arborea savignyi* Irano-Turanian with a Mediterranean penetration.

The dominance of the Eremian forms is thus very obvious, but a particular point of interest is the paucity of Ethiopian elements which Bodenheimer believes to form such a marked element in the southern Hejaz—Yemen mountains and their foot-hills. This apparent discrepancy may be due to the possibility of the mountain chain forming a barrier to the Ethiopian elements, which are confined to its seaward slopes and foot-hills; the present collection was made on the landward side.

Geckonidæ.

Ptyodactylus hasselquisti (Donndorff, 1789).

♂. (No locality.)

This gecko is widely distributed in Arabia from the Hejaz to Oman. Flower (1933, p. 763) has drawn attention to the fact that the numerous local races which undoubtedly exist cannot be satisfactorily designated, even by trinomials, until much more complete information is forthcoming, especially concerning the ecological conditions under which the various races live.

Ceramodactylus doriæ Blanford.

2 specs. (No locality.)

This specific identification is open to question, for unfortunately the specimens are not sufficiently well preserved for a satisfactory comparison to be possible.

Agamidæ.

**Phrynocephalus arabicus* Anderson.

♀. Ramya. 23. 5. 36.
♀. Sahlal, 2500 ft. 21. 9. 36.
5 ♂♂♀♀. (No locality.). 21. 9. 16.

Agama sinaita Heyden.

2 ♂♂, 2 ♀♀, juv. (No locality.)

Agama flavimaculata(Rüppel).

♂♀. Abha, 7250 ft. 12. 6. 36.
6 ♂♂, ♀♀, and juvs. (No locality.)

It seems very probable that *Agama jayakari* Anderson is only an eastern race of *A. flavimaculata*, in which case western specimens should be known as *A. flavimaculata flavimaculata*, the type-locality being Jiddah. Both "species" have been recorded from the Hadramaut and Hasa, which lie on the boundaries of the Oman region from which *jayakari* was originally described, and it is in these areas and Rub' al Khali (from which *jayakari* has been reported) that the two may be expected to intergrade.

Agama adramitana Anderson.

♂. Shaib Hanjur. 2. 6. 36.
♂. On road to Hijla, 6500 ft. 3. 6. 36.
♀. Hijla. 4. 3. 36.
3 ♂♂♀. Abha, 7250 ft. 12. 6. 36.
2 ♂♂, 3 ♀♀. (No locality.)

This series raises considerable doubts as to the validity of *adramitana*. Anderson, when describing the species, diagnosed it as being very closely allied to *Agama annectans* Blanford, originally described from Eritrea, but claimed that the Arabian form was readily recognizable by certain morphological characters :—

(*a*) A rosette of spines on the post-temporal region, and a short well-defined nuchal crest, with a rosette of spines on either side of it, near its middle, are said to be present in *adramitana* but absent in *annectans*.

(*b*) The latter is also said to have only a trace of a lateral fold, and even when this is present it lacks the rosette of spines which characterizes *adramitana*.

(*c*) In the African species the scales are smaller, circa 150 at mid-body instead of about 119, as in the Arabian.

None of these differences appear to be tenable. The present series shows great variation in the degree of keeling of the dorsal scales and associated with this are differences in the degree of development of the rosette of spines on the nuchal region. When the keels are well developed the rosettes and lateral folds are nearly, though not quite, as large as in the type of *adramitana*, but where the dorsal scales are smooth these other structures are almost wanting, as in typical *annectans*. In all the specimens the scales, whether keeled or not, are smaller than in examples from the Hadramaut and are not larger than in *annectans*.

**Uromastyx philbyi*, sp. n.

Holotype a male, number 1938.2.1.1 in the British Museum.

Paratypes, 3 ♂♂, 2 ♀♀, 1 juv., number 1938.2.1.2–7 in the British Museum.

These seven specimens were all collected in the southern part of the Hejaz between Mecca and Shabwa, between the mountains and Rub' al Khali, and appear to represent either an undescribed species or a southern race of *U. ornatus* Heyden. It is preferred to give them specific status, at any rate for the present, owing to the apparent discontinuity of the ranges of the two forms. *U. ornatus* is only known from Midian (Mohila, Heyden, 1827, p. 1), Sinai (Werner, 1893, p. 359; Anderson, 1898, p. 128; Steindachner, 1900, p. 328; Barbour, 1914, p. 83) and possibly southern Palestine (Tristram, 1884, p. 154); Barbour (*loc. cit.*) refers to "Syrian specimens," but this is a palpable error for "Sinai." It has not been recorded from the relatively well-known parts of the northern Hejaz, so that it seems probable that the discontinuity may be real.

The new form is sufficiently closely allied to *ornatus* to render a detailed description unnecessary. It differs in possessing a shorter, broader, more abruptly tapering tail, with fewer annuli, somewhat larger scales on the belly, and shorter toes; the colour is also different from that of most examples of *ornatus*, but Steindachner (*loc. cit.*) has recorded so much variation in this character that too much stress cannot be laid upon it. The morphological differences can be summarized thus:—

(1) Length of tail contained 1·31–1·47 times in the length from snout to vent; in *ornatus* the same ratio is 1·20 to 1·40.

(2) Caudal annuli 19–20; in *ornatus* 22–24.

(3) Maximum caudal width (measured over the spines) contained 3·14 to 3·46 times in its length; the same ratio in *ornatus* varies from 4·45 to 4·6.

(4) Tail not tapering uniformly as in *ornatus*, but scarcely narrower at the middle than anteriorly; the scales in an annulus at the middle vary from 19–20, whereas in *ornatus* there are only about 17.

(5) The ventral scales from the gular to the inguinal folds vary from 67 to 77; in *ornatus* from 77 to 87.

(6) The fourth toe is always appreciably shorter than the distance between the tip of the snout and the anterior border of the ear; in *ornatus* it is as long as (Anderson, *loc. cit.*), or slightly longer than (Heyden), this distance.

The largest male, the type, measures 183 mm. from snout to vent, with a tail of 129 mm.; the corresponding dimensions of the largest female are 155 and 116 mm. The general colour is pale brown, indefinitely reticulated with darker, and the dorsum is crossed by six or seven, often very irregular, rows of small yellow spots, which are usually more or less fused to form narrow bars. Males have the head, gular region, and sides of the belly suffused with blue-black, spotted or reticulated with white. Females and juveniles lack this wash, but the gular region has a few spots and reticulations of dark brown on the yellowish ground-colour.

**Uromastyx benti* (Anderson).

♂. (No locality.)

This is the first record of the species north of Aden and the Hadramaut; the specimen does not differ appreciably from the type-series.

Varanidæ.

**Varanus griseus* Daudin.

2 ♂♂. (No locality.)

Lacertidæ.

Acanthodactylus boskianus asper (Audouin).

2 ♂♂, 2 ♀♀. Ashaira (4000 ft.). 22. 4–18. 5. 36.
♀, 2 juvs. Najran (4400 ft.). 25. 6. 36.
3 ♂♂, 2 ♀♀, 2 juvs. (No locality.)
Specimens were found pairing at Ashaira on May 18th.

Scincidæ.

**Scincus conirostris* Blanford.

2 specs. (No locality.)

**Scincus mitranus* Anderson.

2 specs. (No locality.)

Although this species has not previously been recorded from the Hejaz, it seems to be not uncommon in the southern parts of that country. Col. Philby has obtained it on other occasions.

**Mabuya brevicollis* Wiegmann.

1 spec. Taif.

Chamæleontidæ.

Chamæleo chamæleon orientalis, subsp. n.

Holotype a ♀, number 1935.10.20.15 from Taif, 5500 ft.

Paratypes: ♂, ♀, 2 juvs., from the type-locality; 1 juv. from Barad, 7000 ft.; Hgr. ♀ from Ashaira, 4000 ft.; 1 ♂, 3 ♀♀, 1 juv., from the mountains around Abha.

This series differs appreciably from any of the described races of *Chamæleo chamæleon* in having a longer, narrower head, a character in which it closely approaches *C. calcarifer* Peters. It is distinguished from this latter, however, by the absence of any trace of a tarsal spur. Steindachner (1900, p. 331) described a somewhat similar race from the neighbourhood of Suez, under the name *C. vulgaris* var. *musæ*, and it is to this subspecies that these south-eastern specimens are most closely allied. Three topotypes of *musæ* have been compared with the present series and the distinguishing differences can be summarized thus:—

C. c. orientalis.	*C. c. musæ.*
(1) Distance from the tip of the snout to the commissure of the mouth equal to the distance from the latter point to the extremity of the casque in the very young, but distinctly shorter in the adult.	(1) Length of the mouth greater than the distance from its commissure to the extremity of the casque in juveniles, equal in adults.
(2) Distance between the supra-orbital ridges at the centre of the eyes 3 to 4 times in the length from the snout to the extremity of the casque.	(2) Distance between the supra-orbital ridges 3 to 3·3 times in the same distance.
(3) Parietal crest strongly arched.	(3) Parietal crest only slightly arched.
(4) Scales on the occipital lobes flat, larger than those on the casque.	(4) Scales on the occipital lobes granular; not larger than those on the casque.
(5) Granules on the middle line of the belly transversely enlarged in all except one specimen.	(5) Granules of the middle line not enlarged.

There also appears to be a slight difference in size, for the largest *C. c. musæ* recorded by Werner (1911, p. 10) is only 260 mm., and the largest of Steindachner's specimens only 295 †, whilst the largest of the present series is 342 mm., the tail measuring 174 mm.

On geographical grounds it might be thought that the name *auratus* Gray, described from "Arabia," was applicable to this race, but the type has been examined and found to be not distinct from typical *chamæleon*. There is every probability that the locality "Arabia" is erroneous, for on the bottle containing the type is a small label with the word "Pachuca." It may be

† *Fide* Dr. O. Wettstein, *in litt.*

significant that, when describing *auratus*, Gray mentions a second, similar specimen " said to have been sent from Mexico " ; Pachuca is a Mexican locality, but the specimen can hardly have originated there. Can Pacheco, near Cartagena, have been intended, but misspelt ?

SERPENTES.

Leptotyphlopidæ.

**Leptotyphlops nursii* (Anderson).

1. Najran.

This specimen approaches *L. yemenicus* (Scortecci) in some ways ; the length/diameter ratio is relatively high, about 70, and the supra-oculars are smaller than the frontal ; but the length/diameter ratio must be variable and dependent on nutrition, sex, and preservation (even in the two cotypes of *nursii* it varies from 50 to 61) and the size of the supra-oculars does not appear significant.

Boidæ.

**Eryx jayakari* Boulenger.

1 juv. Sc. 45, V. 167, C. 20+1. (No locality.)

This species was originally described from Muscat, and the type, a female, was said to possess 39 scale-rows. Since then a female has been recorded from Rub' al Khali with 47 scales (Parker, 1931, p. 522), and the British Museum possesses four specimens from the Yemen, two males with 43 scales and two females with 45. Another specimen, the type of *E. fodiens* Annandale, which Werner (1921) considers may represent the same species, is a male and has only 37 scales. Re-examination of the type of *jayakari* reveals the presence of 41 or 42 scales at mid-body, so that when due allowance is made for sex we find the variation to be ♂♂ 37 to 43, ♀♀ 41 to 47, with a tendency towards the higher numbers in the Hejaz and Yemen. Stull (1935, p. 407) records the species also from " El Hassa, Turkey in Asia," which is a very considerable northward extension of its range, but Bird (1936) does not include the species in his list of Turkish reptiles ; possibly " El Hassa " is a mistake for El Hasa, south of Koweit, which is within the known range.

Colubridæ.

Colubrinæ.

Coluber rhodorhachis (Jan).

♂, 2 juvs. Jidda.
Juv. Hadda, Wadi Fatuna, between Jidda and Mecca.
♀. Najran, 4400 ft.
6. (No locality.)

This series contains two strongly contrasting colour-forms. The four from the Jidda region, and three of the others without locality are grey, more or less spotted with darker, but the female from Najran and three others without data are strongly erythristic. In two it is possible to make out that there is some trace of a colour-pattern, the interstitial skin being black in places, but the whole of the upper surfaces of the head and body are bright, reddish pink, the colour becoming more intense caudad and spreading to the lower surface of the tail; the latter is brick-red above. It seems possible that these erythristic individuals may represent an ecological race, the colour being a direct outcome of the environment, for a cobra (*Naja haje arabicus*) from Najran exhibits an exactly similar condition.

**Spalerosophis diadema* (Schlegel).

1 spec. (No locality.)

Boiginæ.

Tarbophis guentheri Aud.

♂. (No locality.)

**Malpolon moilensis* (Reuss).

♀ (Sc. 17, V. 168, C. 63). Jidda.

Micruridæ.

Naja haje arabica Scortecci.

♀. Sc. 19, V. 218, C. 64+*n*. Najran.

This large female cobra, 1795 mm. in length, appears to be of the Arabian subspecies, with the same number of scales about the neck as on the middle of the body, but, like so many of its race, it has the tail docked so that the number of subcaudals cannot be ascertained; there were probably not less than 70. The most remarkable feature of the specimen, however, is its colour. The head and nape are yellowish brown, shading into a bright brick-red which extends over the whole dorsum, being relieved only here and there by the interstitial skin, which in some places is black and gives a fine black edging to the scales. Attention has already been called to the presence of erythristic snakes at Najran (*Coluber rhodorhachis* above) and the possibility that this colour may be associated with environmental conditions.

Viperidæ.

Echis coloratus Gthr.

1 juv. Sc. 33, V. 192, C. 47. (No locality.)

Aspis cerastes Linn.

♀, 2 juvs. Sc. 32, 31, 35, V. 156, 154, 160, C. 32, 38, 35. (No locality.)

AMPHIBIA.

Ranidæ.

**Rana ridibunda* Pallas.

8 ♂♂, ♀♀. Abha. 12. 6. 36.

Bufonidæ.

Bufo regularis subsp.

7 ♂♂. Najran. 5. 7. 36.
2 juvs. Sail, 4000 ft. 12. 5. 36.
2 ♂♂, 3 ♀♀, 2 juvs. (No locality.)

The widespread African toad *B. regularis* Reuss has already been recorded from Midian (Boulenger, 1882, p. 299), from near Mecca (Steindachner, 1900, p. 335), and from the Sinai-Petra region. The present series agrees closely with the example from Midian collected by Burton and with others from Sinai, but it seems probable that these toads ought to receive at least trinomial recognition; they are much smaller (maximum: ♂ 64, ♀ 74 mm.), have a smaller tympanum (2/5 the eye in juvs. to 2/3 in adults), less marked parotoids, and less regular, smaller, dorsal spots. It is possible that one of the many synonyms of *regularis* will be available for application to this race, which extends southwards to the Aden Protectorate, where two specimens were collected at El Kubar by Bury.

**Bufo dhufarensis* Parker.

Bufo andersoni (part.) Boulenger, 1887, Ann. & Mag. Nat. Hist. (5) xx. p. 408; Anderson, 1895, Proc. Zool. Soc. London, p. 662, pl. xxxvii. fig. 3; *idem*. 1901, *op. cit.* p. 152.

♂. Mecca. 9. 3. 36.

A good deal of confusion in the nomenclature of the toads of S.E. Arabia has been caused by the fact that the three cotypes of *Bufo andersoni* Boulenger are really representatives of two species. Two of the specimens, those from Ajmere, Rajputana, are representatives of a broad-headed species in which the interorbit is much wider than an upper eyelid, the tympanum is large and distinct, measuring 2/3 the orbital diameter, the toes 2/3 to 3/4 webbed, and the canthus rostralis marked, with the loreal region only slightly oblique. It is from these specimens that the description was principally drawn up, and the name *andersoni* must be retained for the species they represent; additional specimens from Tatta and Fyzabad have been seen. The other cotype was originally said to be without locality, but was subsequently found to have been collected in Muscat. It represents a different species, which has a much more rounded, blunter snout, with very oblique lores and obtuse canthus, an interorbit not wider than the upper eyelid, a tympanum less distinct and measuring only half the ocular length, and less-webbed toes. This specimen almost certainly belongs to the form subsequently described by Werner (1896, p. 20) as *Bufo viridis* var. *orientalis*. Cotypes of this name have been compared with the Muscat cotype of *andersoni* and found to be conspecific, and six other specimens from Muscat, referred to *andersoni* by Boulenger (1887, p. 408), also belong to this form, which must bear the name *Bufo orientalis* Werner.

True *Bufo andersoni* does not appear to occur in Arabia, but there is a form resembling it, with a large distinct tympanum, broad interorbit, angular canthus, and nearly vertical lores. This, the comparatively recently described *dhufarensis*, has also been confused with *andersoni*, as the foregoing partial synonymy indicates, but is distinguished by its more prominent, more acuminate snout, even more vertical lores, scarcely more than half-webbed toes, very indistinct paratoids, and the numerous closely-set spinules which cover the whole of the dorsum, even in juveniles. This species seems to be almost intermediate between *dodsoni* of N.E. Africa and the Indian *andersoni*; it was originally described from a single female from Dhufar, but its range extends across the whole of S.E. Arabia, the following specimens having been examined, in addition to the holotype and the male from Mecca mentioned above:–

Imm. ♀. Muscat (coll. Jayakar).
3 juvs., larva. Haithalhin, Aden (coll. Yerbury).
? 2 larvæ. Hadramaut (coll. Bent).
♂. Sheikh Othman (coll. Percival).
2 juvs. Shaib Usaila, 20 miles from Jidda (coll. Philby).

Hylidæ.

**Hyla arborea savignyi* Audouin.

3 ♂♂, 2 ♀♀. Abha, 7250 ft. 12 6. 36.

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LVI.—*The Piaget Collection of Mallophaga.*—Part III.

By Gordon B. Thompson.

[Continued from p. 271.]

Species.	No. of specimens in B.M.	No. of slides.	Hosts.
Trichodectes appendiculatus Piaget.	2 ♀♀, 2 ♂♂.	2	*Antilope subgutturosa.*
T. climax Nitzsch in Gervais	13 ♀♀, 5 ♂♂.	9	*Capra angorensis.* *Capra hircus* var. *indica.* *Capra hircus.* " Sur une chèvre."
T. climax var. *truncata* Piaget	7 ♀♀, 6 ♂♂. 2 imm.	3	" Chèvre de Java."
T. crenulatus Piaget	3 ♀♀, 3 ♂♂.	2	*Antilope albifrons.*
T. crassus Nitzsch in Denny	12 ♀♀, 7 ♂♂.	8	*Meles taxus.*
T. dubius Nitzsch in Denny	17 ♀♀, 11 ♂♂.	12	*Mustela erminea.* *Mustela vulgaris.*
T. exilis Nitzsch in Giebel	11 ♀♀, 7 ♂♂.	3	*Lutra vulgaris.*
T. forficula Piaget	4 ♀♀, 3 ♂♂.	3	*Cervus porcinus.*
T. inæqualis Piaget.............	5 ♀♀, 4 ♂♂.	4	*Herpestes ichneumon.*
T. inæqualimaculatus Piaget	3 ♀♀, 1 ♂.	2	" Sur un Guanaco " (*Auchenia guanaco*).
T. latus Nitzsch in Burmeister ...	10 ♀♀, 8 ♂♂.	7	*Canis familiaris.* " Sur un chien."
T. pallidus Piaget	6 ♀♀, 4 ♂♂.	4	*Nasua fusca.*
T. parumpilosus Piaget	4 ♀♀.	2	" Sur un cheval." *Equus caballus.*
T. parumpilosus var. *tarsata* Piaget	12 ♀♀, 2 ♂♂.	4	" Cheval de Java." " Cheval de Birma."
T. parumpilosus var. *ocellatus* Piaget.	5 ♀♀, eggs.	3	*Equus bruchelli.*
T. penicillatus Piaget	1 ♀, 1 ♂.	1	*Macropus penicillatus.*
T. pilosus Giebel	6 ♀♀, 1 ♂.	3	" Sur un âne." *Equus asinus.*
T. pinguis Nitzsch in Burmeister .	1 ♀.	1	*Ursus arctos.*
T. punctum Piaget	2 ♀♀.	1	*Lamprotornis æneus.*
T. retusus Nitzsch in Burmeister .	1 ♀.	1	*Mustela erminea.*
T. scalaris Nitzsch in Burmeister .	8 ♀♀.	2	" Sur un veau."
T. sphærocephalus Olfers	2 ♀♀, 2 ♂♂.	2	(*Ovis ornata.*)
T. subrostratus Nitzsch in Burmeister.	2 ♀♀, 2 ♂♂.	2	" Sur un chat."
T. tibialis Piaget	16 ♀♀ *.	6	*Cervus dama.* *Cervus dama* var. *alba.* *Cervus capreolus.*
T. vulpis Denny	2 ♀♀.	1	*Canis vulpes.*
Goniodes aculeatus Piaget........	1 ♀.	1	*Momotus lessonii.*
G. assimilis Piaget	2 ♂♂.	1	*Francolinus capensis.*
G. bicuspidatus Piaget	15 ♀♀, 13 ♂♂.	13	*Tragopan cobetii.* *Tragopan temminckii.* *Tragopan satyrus.*

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* The measurements of a male are given with the original description, but there is no male in the collection.

Species.	No. of specimens in B.M.	No. of slides.	Hosts.
G. breviantennatus Piaget	4 ♀♀, 4 ♂♂.	4	*Perdix chukar.*
G. cervinicornis Giebel	6 ♀♀, 2 ♂♂.	4	*Tragopan satyrus.* *Phasianus nycthemerus.*
G. chelicornis Nitzsch in Lyonet ..	3 ♀♀, 4 ♂♂, 3 imm., eggs.	5	*Tetrao urogallus.*
G. colchicus Denny	8 ♀♀, 8 ♂♂.	8	*Phasianus pictus.* *Phasianus colchicus.* *Phasianus veneratus.* *Phasianus veneratus reevesi*
G. complanatus Piaget	4 ♀♀, 1 ? ♂.	2	*Tinamus obsoletus.* *Tinamus obsoletus* (Colombia).
G. cupido Giebel	3 ♀♀, 2 ♂♂.	2	*Tetrao cupido.*
G. dilatatus Rudow	6 ♀♀, 4 ♂♂.	5	*Tinamus variegatus.* *Tinamus julius.*
G. dispar Nitzsch in Burmeister ..	2 ♀♀, 1 ♂.	2	*Perdix cinerea.* *Tinamus variegatus.*
G. dispar var. *minor* Piaget	1 ♂.	1	*Perdix californica.*
G. dissimilis Nitzsch in Denny ..	6 ♀♀, 3 ♂♂.	5	*Gallus domesticus.* *Anas tadorna.* *Phasianus colchicus.*
G. dissimilis var. *bankiva* Piaget..	1 ♀ *.	1	*Gallus bankiva.*
G. elongatus Piaget	2 ♀♀, 1 ♂.	2	*Picus major.* *Excalfactoria australis.*
G. eurygaster Piaget	10 ♀♀, 3 ♂♂.	6	*Lophophorus impeyanus.*
G. excavatus Piaget	1 ♀, 1 ♂♂.	1	*Tinamus canus.*
G. falcicornis Nitzsch in Burmeister.	7 ♀♀, 7 ♂♂, 3 imm.	8	*Pavo cristatus.* *Pavo nigripennis.* *Pavo cristatus* var. *alba.*
G. fasciatus Piaget	1 ♂.	1	*Treron vernans.*
G. heteroceros Nitzsch in Giebel...	3 ♀♀, 3 ♂♂, 2 imm.	4	*Tetrao tetrix.* *Tetrao scoticus.*
G. lævis Piaget................	6 ♀♀, 3 ♂♂.	5	*Cryptonyx coronatus.* *Anas acuta.*
G. laticeps Piaget	1 ♂.	1	*Tinamus julius* (Colombia).
G. latifasciatus Piaget	3 ♀♀, 4 ♂♂.	4	*Euplocamus ignitus.* *Euplocamus pyronotus.*
G. longipes Piaget	2 ♀♀, 2 ♂♂.	2	*Corax galeatus.*
G. major Piaget	1 ♀, 1 ♂.	1	*Crossoptilon auritum.*
G. minor Piaget	10 ♀♀, 9 ♂♂.	10	*Columba risoria.* *Columba tigrina.* *Columba bitorquata.* *Columba domestica.*
G. minor var. *setosa* Piaget	1 ♀.	1	*Treron abyssinicum.*
G. ortygis Denny	2 ♀♀.	1	*Ortyx virginiana.*
G. parviceps Piaget	2 ♀♀, 2 ♂♂.	2	*Pavo cristatus.*
G. setosus Piaget	1 ♀.	1	*Tinamus variegatus.*
G. sexpunctatus Piaget	2 ♀♀, 2 ♂♂.	2	*Rhynchotus rufinus.*

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* Males of this var. are mentioned in the original description, but there are none in the collection.

Species.	No. of specimens in B.M.	No. of slides.	Hosts.
G. spinosus Piaget	1 ♂.	1	*Tinamus julius.*
G. stylifer Nitzsch in Burmeister	6 ♀♀, 8 ♂♂, 10 imm.	10	*Palamedea chavaria.* *Pavo specifer.* *Meleagris gallopavo.*
G. subdilatatus Piaget	5 ♀♀, 5 ♂♂.	5	*Tinamus variegatus.*
G. suborbiculatus Piaget	1 ♂.	1	*Goura victoriæ.*
G. truncata Giebel	3 ♀♀, 1 ♂.	2	*Perdix rubra.*
Goniocotes abdominalis Piaget	3 ♀♀, 3 ♂♂.	3	*Gallus domesticus.*
G. abdominalis var. *latifasciatus* Piaget.	1 ♀.	1	*Agelastus meleagrides.*
G. alatofasciatus Piaget	1 ♀*.	1	*Rhynchotus rufinus.*
G. alatus Piaget	5 ♀♀.	2	*Perdix chukar.*
G. asterocephalus Nitzsch in Burmeister.	1 ♀, 1 ♂.	1	*Perdix coturnix.*
G. bifasciatus Piaget	4 ♀♀, 3 ♂♂.	3	*Spheniscus magellanicus.*
G. bisetosus Piaget	1 ♀.	1	*Geotrygon linearis.*
G. candidus Piaget	1 ♀.	1	*Ptilopus cinctus florensis.*
G. candidus var. *pallida* Piaget †	1 ♂.	1	*Glycyphila fasciata.*
G. chrysocephalus Giebel	8 ♀♀, 5 ♂♂.	8	*Euplocamus pyronotus.* *Euplocamus ignitus.* *Phasianus nycthemerus.* *Phasianus sommeringi.* *Phasianus pictus.*
G. chrysocephalus var. *rotundiceps* Piaget.	3 ♀♀, 1 ♂.	3	*Phasianus reevesii.* *Euplocamus pyronotus.*
G. compar Nitzsch in Burmeister	8 ♀♀, 5 ♂♂, 6 imm.	7	*Columba phasianella.* *Columba domestica.* *Columba palumbus.* *Columba turtur.* " Pigeon domestique."
G. coronatus Giebel	2 ♀♀.	1	*Cryptonyx coronatus.*
G. coxatus Piaget	1 ♂.	1	*Tinamus solitarius.*
G. crassipes Piaget	1 ♂.	1	*Tallegallus cuvieri.*
G. diplogonus Nitzsch in Giebel	1 ♀ ‡.	1	*Tragopan temmincki.*
G. eurygaster Piaget	5 ♀♀, 1 ♂.	3	*Buceros albocristatus.* *Oreoperdix crudigularis.*
G. fasciatus Piaget	1 ♀, 1 ♂.	1	*Nymphicus n-hollandiæ.*
G. haplogonus Nitzsch in Giebel	1 ♂.	1	*Lophophorus impeyanus.*
G. hologaster Nitzsch in Burmeister.	17 ♀♀, 6 ♂♂.	8	*Gallophasis cuvieri.* *Ortyx virginiana.* *Gallus bankiva* (Java).
G. laticeps Piaget	2 ♀♀ ‡.	1	*Epimachus albus.*
G. latus Piaget	3 ♀♀ ‡.	2	*Goura coronata* (Madag.). *Goura coronata.*

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* The measurements of a male are given with the original description ,but there is no male in the collection.

† This var. is referred to as *pellucida* in the 'Monograph.' A female is mentioned, but there is no female in the collection.

‡ A male is mentioned in the original description, but there is no male in the collection.

Species.	No. of specimens in B.M.	No. of slides.	Hosts.
G. major Piaget	8 ♀♀, 7 ♂♂, imm.	9	*Megapodium rubripes* var. *gilberti*. *Megapodium rubripes* var. *duperreyi*. *Megapodium rubripes* var. *forsteni*. *Megapodium freycineti*.
G. menadensis Piaget	3 ♀♀.	2	*Macropygia menadensis*.
G. microthorax Nitzsch in Giebel	1 ♀ *.	1	*Perdix cinerea*.
G. minor Piaget	9 ♀♀, 6 ♂♂.	6	*Megapodium duperreyi*. *Megapodium rubripes* var. *forsteni*. *Megapodium rubripes* var. *gilberti*.
G. pallidomaculatus Piaget	2 ♀♀, 2 ♂♂.	2	*Perdix javanica*.
G. pallidiflavus † Piaget	2 ♀♀.	1	*Megacephalon maleo*.
G. quadraticeps Piaget	2 ♂♂ ‡.	1	*Paradisea papuana*.
G. rectangulatus	7 ♀♀, 2 ♂♂.	5	*Pavo spicifer*. *Pavo cristatus*. *Pavo cristatus* var. *alba*. *Upupa epops*.
G. sexsetosus Piaget	2 ♀♀, 2 ♂♂.	2	*Rhynchotus rufinus*.

[To be continued.]

LVII.—*A new Tintinnid from Lake Windermere.*

By G. H. Wailes.

Several individuals of an hitherto undescribed species of *Tintinnopsis* were observed during September 1937 in the plankton of Lake Windermere; they were collected during a visit to the laboratory of the Freshwater Biological Association at Wray Castle, near Ambleside, which is under the direction of Dr. E. B. Worthington.

Records of the occurrence in fresh water of members of this essentially marine family are comparatively scarce, although some species may at times form a not unimportant constituent of the nanno-plankton of lakes.

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* A male is mentioned in the description, but there is no male in the collection.

† Spelt "*pallidoflavus*" on the label.

‡ A female is mentioned in the original description, but there is on female in the collection.

Class CILIATA.

Family **Tintinnoinea.**

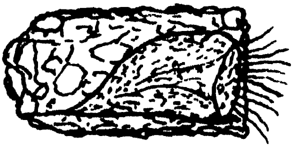
Tintinnopsis wrayi, sp. n.

Test small, cylindrical, parallel, twice as long as broad; fundus hemispherical, aperture circular, without projections; formed of transparent pellicle light brown in colour, sparsely covered with irregularly shaped thin scales or particles.

Animal normal, attached to test near fundus by contractile filament.

Dimensions.—Diameter of test 20 μ, length 40 μ.

Distribution.—In the plankton of Lake Windermere, Westmorland, England.



Tintinnopsis wrayi Wailes, × 800. From Lake Windermere.

Remarks.—The species most nearly resembling it are:

T. cylindrata K. & C., with a diameter 10 to 12 μ and length equal to four diameters; from lakes in Hungary.

T. minuta Wailes; diameter 10 to 12 μ, length equal to 2·3 diameters; habitat marine.

T. entzii Daday; diameter 30 μ, length 1¼ diameter; from lakes in Hungary. Considered, however, by Kofoid and Campbell to be a doubtful species.

For a conspectus of the family and references to the literature Kofoid and Campbell, ' Marine and Freshwater Tintinnoinea ' (Univ. California Press, vol. xxxiv. 1929), should be consulted.

My thanks are due to Mr. D. J. Scourfield for the opportunity of observing an active individual of *T. wrayi*, obtained by centrifuging a sample of surface water from Lake Windermere.

LVIII.—*A new Subfamily of Malaysian* Dysodiidæ (*Rhynchota*). By N. C. E. Miller, F.R.E.S., F.Z.S., Entomologist, Department of Agriculture, S.S. and F.M.S.

While collecting at The Gap (4000 ft.), Selangor, Federated Malay States, in December 1936, I came across a solitary specimen of a bug of remarkable shape, which apparently had been dislodged from its resting place by recent heavy rain. It was lying on a stone parapet at the roadside and was still alive when picked up.

With a view to obtaining ova, I did not kill the specimen, and since its shape suggested that its habitat was probably under the bark of decaying trees, I placed it with some dead wood, which was maintained in a moist state. On this material it survived for a period of about six weeks and then died without having produced ova.

Later on, in the following year, while examining the collections of the Selangor Museum, Kuala Lumpur, Federated Malay States, I discovered more individuals of the same and of related species, which Mr. H. M. Pendlebury, Director of Museums, informed me had been submitted to the British Museum (Natural History), London, but had not yet been named. He suggested that I might care to take them to England when I went on leave and endeavour to determine them.

Although knowledge regarding these insects is almost non-existent, it seems reasonable to suppose that they live under the bark of decaying trees and, as suggested by Mr. W. E. China of the British Museum, the great length of the mouthparts, which are coiled in repose in the apex of the head, indicates that they most probably obtain their nourishment from the mycelia of fungi. The coiled position of the mouthparts when not in use is a condition which also obtains in the Aradidæ.

An examination of the available material has revealed seven new species.

In the preparation of this paper I am very greatly indebted to Mr. China for his kindness in elucidating many of the problems which arose. My thanks are also due to Mr. H. M. Pendlebury for affording me the opportunity of examining the specimens in the Selangor Museum.

The types are in the British Museum (Natural History), London.

Dysodiidæ Reuter, 1912.

CHELONOCORINÆ *, subfam. nov.

The members of this new subfamily are triangular in outline, flattened dorso-ventrally and apterous. The tarsi are composed of two segments. In colour, as in the Dysodiinæ and Aradidæ, they are mostly black or dark piceous, but they differ from the members of the latter family in having the prosternum narrowly and feebly sulcate and the meso- and metasterna broadly, shallowly, ovately depressed. Furthermore, the rostrum is shorter, the apical process of the head bifurcate, the eyes feebly prominent, the first segment of the antennæ as long or longer than the head and of approximately the same thickness throughout, with the apex feebly bilobate.

They differ from members of the Dysodiinæ in the structure of the sternites, the absence of postocular spines, the length of the first antennal segment and the indistinct delimitation of the trochantera (partial fusion with the femora).

In this subfamily also it will be seen that the pro- and mesothorax are fused.

A striking feature is presented by the abdomen, which has a very broad connexival area, and the dorsum (the part usually covered by the elytra) has a complicated pattern of plate-like areas of varying shape, each with a small circular depression or very low prominence. The arrangement of these plate-like areas consists usually of two parallel rows of large areas subdorsally and a row adjoining the connexival area laterally.

Dorsally there is frequently present along the middle line an irregular tumescent ridge. The seventh abdominal segment is strongly produced apically.

The connexival area frequently has on each segment obscure glabrous areas not unlike trichobothrial areas in other families, *e.g.*, Lygæidæ.

Another feature of this subfamily is the dense tomentose clothing which extends over most parts of the body, with the exception of some of the dorsal plate-like areas and the small circular areas within them.

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* *χελώνη* a tortoise, *κόρις* a bug. In connection with the tortoise-shell-like plates on the dorsum of the abdomen.

CHELONOCORIS, gen. nov.

Head rather long and narrow with the apical process bifurcate. Rostrum much shorter than the head, apparently composed of three segments, the apparent basal segment strongly constricted laterally. Antennæ with the first segment as long or longer than the head; apical segment short, pyriform. Metathoracic gland ostioles visible from above. Abdomen with irregular prominences dorsally and parallel rows of plate-like areas of irregular pattern; segment 7 produced apically and segment 8 irregularly conically produced. Species sexually dimorphic.

Chelonocoris truncatus, sp. n. (Fig. 1.)

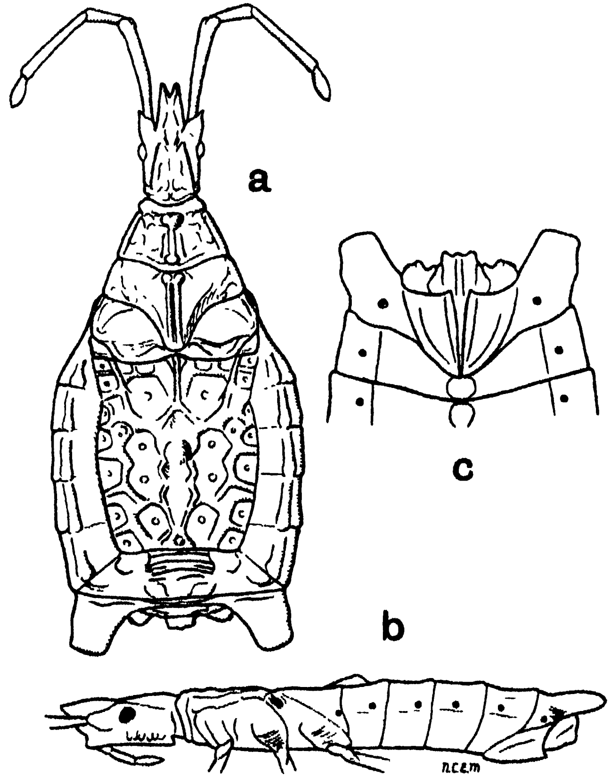
Colour.—Black. Antennæ: base of segment 1, apex of segment 2, greater part of segments 3 and 4 dark castaneous. Eyes dark ochreous. Abdomen: central areas in plate-like areas and glabrous areas on connexivum ferruginous; midventral, subventral, and connexival areas ventrally castaneous. Legs piceous; tarsi castaneous. Tomentose clothing and setæ fulvous.

Structure.—*Antennæ*: segment 1 subequal to head in length; segment 2 one-third as long as 1; segment 3 about three times as long as 2; segment 4 subequal to 2. *Eyes* small, subreniform. *Head* somewhat wider anteriorly than posteriorly; frons basally and genæ irregularly sulcate; inner margins of genæ deeply sulcate; clypeus obliquely sulcate; anterior margin of bucculæ obtuse. *Thorax*: anterior margin of pronotal collar broadly concave; disc of anterior lobe deeply longitudianally sulcate middorsally, irregularly sulcate tuberculate laterally; mesothorax with longitudinal parallel carinæ middorsally; laterally irregularly depressed and punctate; prosternum feebly longitudinally sulcate; meso- and metasterna feebly ovately depressed. *Abdomen*: apical external angles of connexivum feebly prominent, rounded; apical margin thickened medially; produced portion of segment 7 quadrate, relatively short; segment 8 bluntly conical apically. *Legs*: femora feebly constricted subbasally and subapically.

Total length 18·0 mm.*.

Described from 1 ♀ (type), Taiping, Perak, F.M.S. (ex coll. F.M.S. Museums).

Fig. 1.



Chelonocoris truncatus, sp. n., ♀.
a, from above ; *b*, from side ; *c*, apex of abdomen ventrally.

Chelonocoris acuminatus, sp. n. (Fig. 2).

Colour.—Black. Eyes castaneous. Tomentose clothing dark fulvous.

Structure.—*Antennæ*: segment 1 subequal in length to anterior femora and about five times as long as segment 2, feebly thicker in basal half; remaining segments missing.

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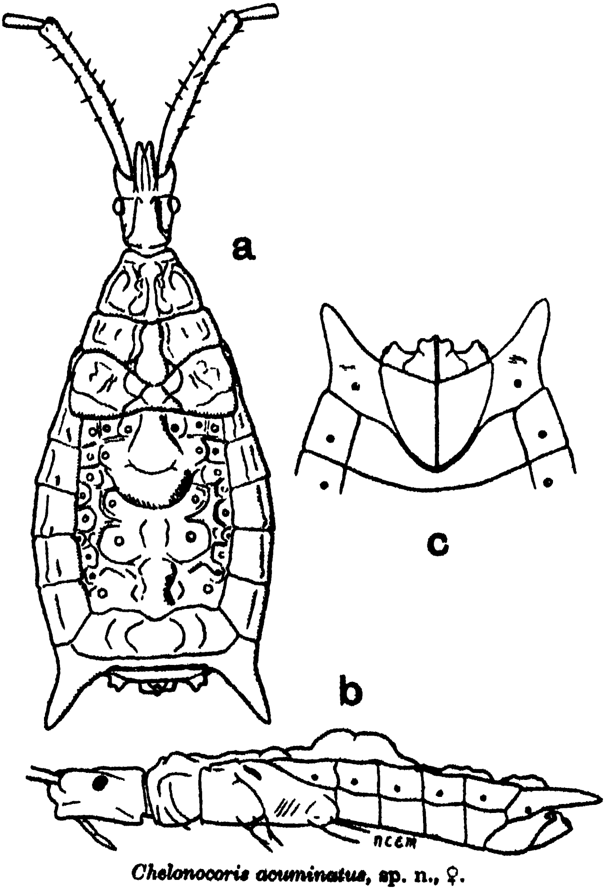
* All measurements are taken from the apex of apical process of head to apex of produced portion of 7th abdominal segment.

Eyes subreniform. *Head*: genæ laterally sulcate; base of frons smooth. *Thorax*: anterior lobe with a median anterior, a subdorsal basal and a median lateral low prominence; mesothorax with a dorsal, moderately broad rounded carina extending to scutellar area; sternites broadly depressed. *Abdomen*: produced portion of segment 7 subacute apically. *Legs* coarsely sparsely setose.

Fig. 2.

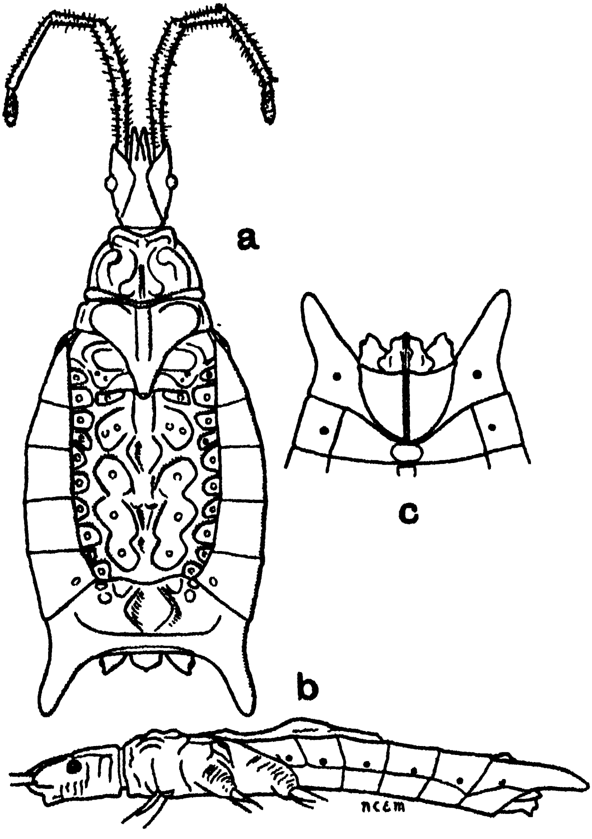


Chelonocoris acuminatus, sp. n., ♀.
a, from above; *b*, from side; *c*, apex of abdomen ventrally.

Total length 18·0 mm.

Described from 1 ♀ (type), Trusan, Sarawak, Borneo, January 1915 (*H. W. Smith*); 1 ♀, Mt. Dulit, Sarawak, Borneo. Kalabit Exped. 1924 (*Dr. E. Mjöberg*).

Fig. 3.



Chelonocoris bufo, sp. n., ♀.
a, from above; *b*, from side; *c*, apex of abdomen ventrally.

Chelonocoris bufo, sp. n. (Fig. 3.)

Colour.—Black; setæ and tomentose clothing fulvous; basal segment of tarsi and claws castaneous.

Structure.—Antennæ: segment 1 curved, subequal in length to posterior tibiæ; segment 2 about one-fourth as long as 1; segment 3 twice as long as segment 2; segment 4 about two-thirds as long as 2; segments 1–3 with erect or suberect moderately long sparse setæ; segment 4 with dense short setæ apically and sparse forwardly directed setæ. *Eyes* moderately prominent, ovate, with the lower margin almost straight. *Head*: lobes of apical process subacute; genæ and lateral area deeply transversely sulcate; anteocular portion somewhat broader than postocular portion. *Thorax*: scutellar area somewhat acutely produced apically; prosternum feebly longitudinally sulcate; meso- and metasterna shallowly broadly depressed. *Abdomen*: connexivum inclined upwards, strongly, longitudinally sulcate near external margin, apical margins of each segment thickened medially; apex of produced portion of segment 7 broadly conical; apex of segment subacute. Head, body, and legs with erect moderately long setæ.

Total length 17·5 mm.

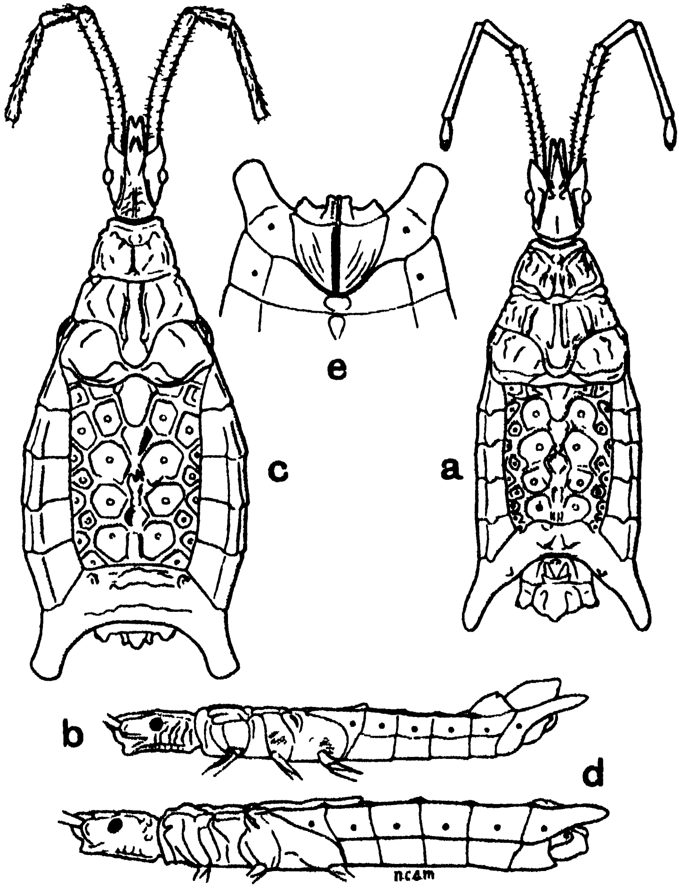
Described from 1 ♀ (type), The Gap, Selangor, F.M.S. (4000 ft.), 26. xii. 36 (*N. C. E. Miller*); 1 ♀. Gunong Kledang, Perak, F.M.S., November 1916; 2 ♀♀, Perak, Distant Coll., 1911.

Chelonocoris peregrinus, sp. n. (Fig. 4.)

Colour.—Dark piceous. Apex of segment 4 of antennæ castaneous. Setæ and tomentose clothing dark fulvous.

Structure.—*Antennæ*: (♂), segment 1 feebly curved, subequal to posterior tibiæ, (♀), to anterior tibiæ; segment 2 about one-fourth as long as 1; segment 3 three-fourths as long as 1; segment 4 two-thirds as long as 2. *Eyes* subspherical, moderately prominent. *Head*: anteocular portion somewhat broader than postocular portion; external margin of antennal tubercles broadly rounded; lobes of apical process narrowly rounded apically; interocular area with two median low tubercles; lower lateral margin deeply sulcate; genæ deeply irregularly transversely sulcate. *Thorax*: lateral margins of anterior lobe moderately rounded; scutellar area longitudinally sulcate subdorsally, the sulci not reaching posterior margin; subapically feebly transversely sulcate; prosternum moderately deeply sulcate; meso- and metasterna broadly shallowly depressed. *Abdomen*: connexivum feebly inclined upwards, longitudinally sulcate and carinate, the apex of carinæ thickened; raised area along middorsum feeble; produced portion of segment 7 feebly curved, projecting outwards and narrowly rounded

Fig. 4.



Chelonocoris peregrinus, sp. n., ♂ and ♀.
a, from above, ♂; *b*, from side, ♂; *c*, from above, ♀; *d*, from side, ♀; *e*, apex of abdomen ventrally, ♀.

apically. In the female the apex of the produced portion is more broadly rounded and relatively shorter.

Total length: ♂ 17·0 mm., ♀ 19·5 mm.

Described from 1 ♂ (type), Aring, Distant Coll. 1911; 2 ♂♂, Malacca, Fry Coll., 1905; 1 ♂, Gunong Tahan, Pahang, F.M.S., 2500–3500 ft., May–July 1905 (*H. C. Robinson*); 1 ♀, Gombak Valley, October 16, 1921 (*H. M. Pendlebury*) (the location of Aring is presumably in N. Borneo).

Chelonocoris malayensis, sp. n. (Fig. 5.)

Colour.—Black. Clothing and setæ dark castaneous; setæ on apical segment of antennæ pale fulvous; tarsi castaneous.

Structure.—*Antennæ*: segment 1 subequal in length to head; segment 2 about one-third as long as 1; segment 3 a little more than twice as long as 2; segment 4 two-thirds as long as 2. *Eyes* subspherical, moderately prominent. *Head*: external margins of apical process feebly arcuate; anteocular portion a little shorter than postocular portion; external margin of antennal tubercles rounded; genæ irregularly transversely sulcate. *Thorax*: anterior margin of pronotal collar broadly, feebly concave; anterior lobe with a median low tubercle near anterior margin, a moderately large rounded tubercle sublaterally anteriorly and a low tubercle subdorsally posteriorly; scutellar area with a median somewhat indistinct rounded carina in basal half; prosternum with a median sulcus widening posteriorly; meso- and metasterna feebly broadly depressed. *Abdomen*: external margins subparallel; connexivum feebly longitudinally carinate sublaterally; not inclined upwards; external margin of produced portion of segment 7 feebly curved; apex narrowly rounded; tubercle at base of produced portion moderately long; apical margin of segment 6 bituberculate; apex of middorsal prominence triangularly depressed; central area in plate-like areas feebly raised. *Legs* erectly and moderately densely setose.

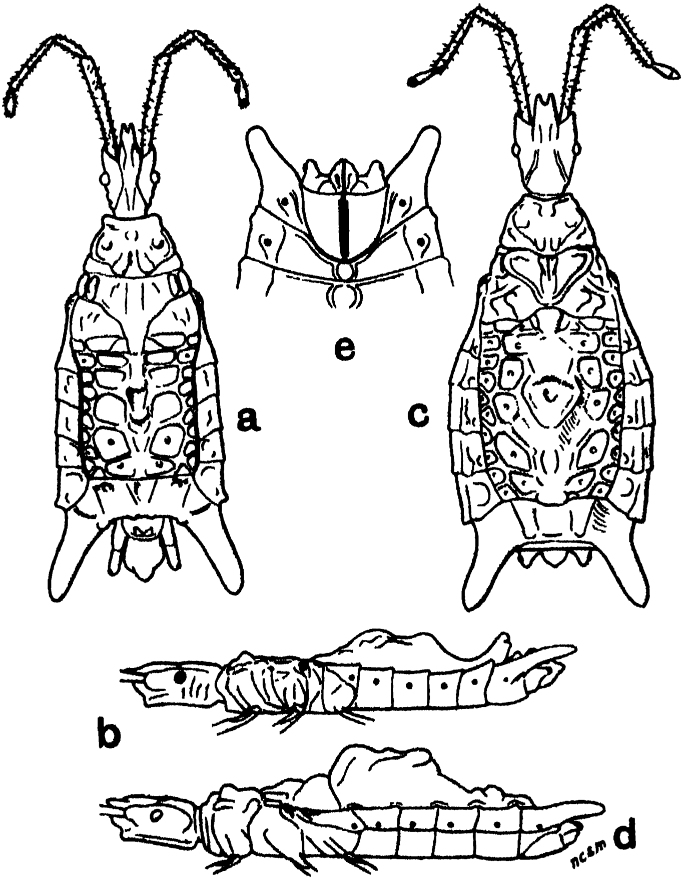
In the female the middorsal prominence and the ridges separating plate-like areas are more pronounced.

Tomentose clothing in both sexes very dense.

Total length: ♂ 15·0 mm., ♀ 16·0 mm.

Described from 1 ♂ (type), Cameron Highlands, Pahang, F.M.S. (5–6000 ft.), 9. vi. 35; 1 ♂ and 1 ♀, Sungai Parang, Cameron Highlands (4850 ft.), 24. v. 31; 1 ♂ and 1 ♀, Sungai Rotan, Cameron Highlands (4200 ft.), 24. v. 31 ; 1 ♂, Tanah Rata, Cameron Highlands (4800 ft.), 19. v. 31 ; 1 ♂ and 1 ♀, Parit Falls, Cameron Highlands (4800 ft.),

Fig. 5.



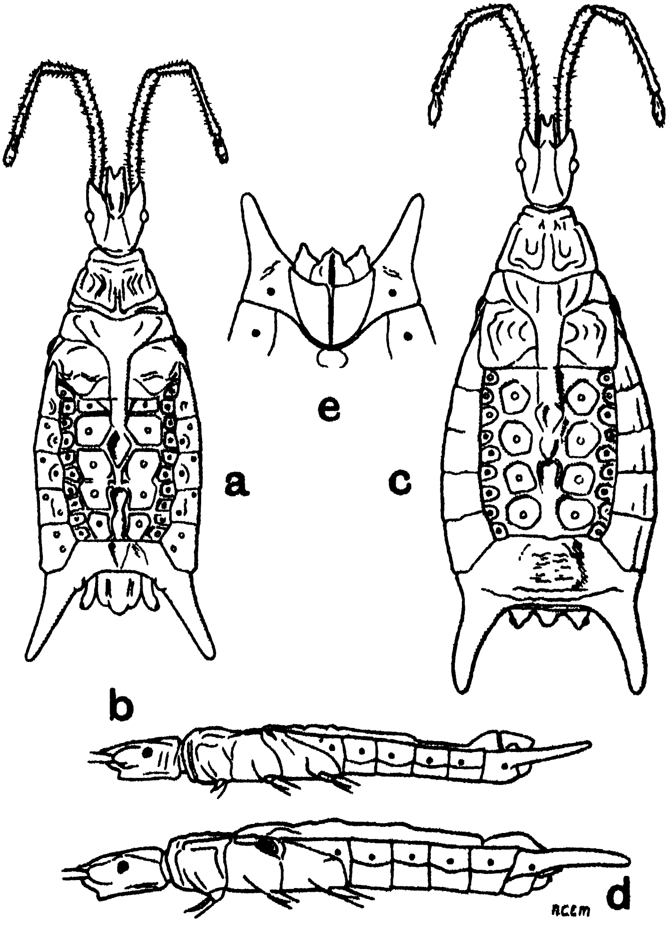
Chelonocoris malayensis, sp. n., ♂ and ♀.
a, from above ♂, ; *b*, from side, ♂ ; *c*, from above, ♀ ; *d*, from side, ♀ ; *e*, apex of abdomen ventrally, ♀.

25. v. 31 ; 1 ♀, Tanah Rata, 14. iii. 35 (all *H. M. Pendlebury*).

Chelonocoris dyak, sp. n. (Fig. 6.)

Colour.—Black, except head, antennæ and legs dark castaneous. Clothing and setæ fulvous. Eyes castaneous.

Fig. 6.



Chelonocoris dyak, sp. n., ♂ and ♀.

a, from above, ♂ ; *b*, from side, ♂ ; *c*, from above, ♀ ; *d*, from above, ♀ ; *e*, apex of abdomen ventrally, ♀.

Structure.—*Antennæ* : segment 1 feebly curved, nearly twice as long as head ; segment 2 one-fourth as long as 1 ;

segment 3 about half as long as 1; segment 4 two-thirds as long as 2. *Eyes* moderately prominent, ovate, with the anterior and lower margins almost straight. *Head*: anteocular portion subequal in length to postocular portion; external margins of antennal tubercles rounded; lobes of apical process feebly divergent and feebly constricted basally. *Thorax*: external margins of anterior lobe rounded; posterior margin sinuate; tubercles on disc feeble; scutellar area narrow and convex; prosternum feebly sulcate; meso- and metasterna feebly depressed. *Abdomen*: external margin feebly rounded, subparallel; middorsal prominence with a subcircular depression in the region of segments 3 and 4 and an elongate ovate depression on segment 5; ridges enclosing plate-like areas prominent; produced portion of segment 7 rather long, straight, acute. *Legs*: femora feebly thickened medially.

In the female the produced portions of segment 7 are feebly curved.

Total length: ♂ 14·5 mm., ♀ 16·0 mm.

Described from 1 ♂ (type), Sarawak, Shelford, 1900; 2 ♀♀, Sarawak, Shelford, 1900; 1 ♀, Kuching, Borneo, 2. viii. 99, Distant Coll.

Chelonocoris macilentus, sp. n. (Fig. 7.)

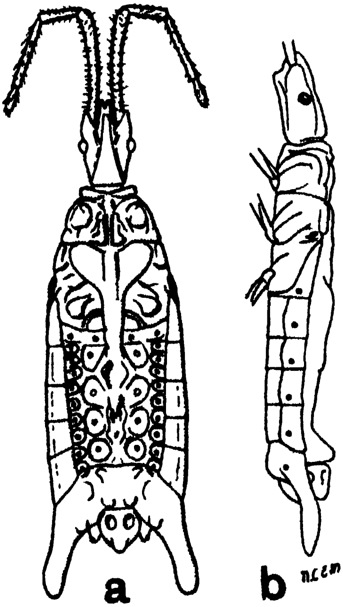
Colour.—Black. Antennæ dark castaneous. Clothing and setæ fulvous; apical setæ on segment 4 of antennæ pale stramineous.

Structure.—Antennæ: segment 1 moderately curved, about one-third longer than head; segments 2 and 3 together subequal to 1; segment 4 two-thirds as long as 2. *Eyes* feebly prominent, ovate, with the anterior and lower margins almost straight. *Head*: anteocular portion considerably shorter than postocular portion; lobes of apical process short, narrowly rounded apically, subacute in profile. *Thorax*: anterior lobe deeply, medially sulcate; laterally with a broad raised area; scutellar area elongate; metathorax with an elongate prominence sublaterally; prosternum feebly sulcate; meso-and metasterna ovately depressed. *Abdomen* relatively narrow; lateral margins almost straight, subparallel; ridges separating plate-like areas prominent; middorsal longitudinal ridge low; area in region of segments 3 and 4 feebly ovately depressed;

produced portion of segment 7 feebly curved, relatively robust.

Total length 15·0 mm.

Fig. 7.



Chelonocoris macilentus, sp. n., ♂.
a, from above ; *b*, from side.

Described from 1 ♂ (type), Singapore, 1896 (*H. N. Ridley*).

LIX.—*Notes on the Spotted Skunks* (*Genus* Spilogale), *with Accounts of new Subspecies from Mexico and Costa Rica*. By E. Raymond Hall.

An interest in the American Mustelidæ has naturally led to study of the rich and historically important collections in the British Museum of Natural History. One result of this study is the recognition of two heretofore undescribed geographic races of *Spilogale*, which, through the kindness of Mr. M. A. C. Hinton, Keeper of Zoology, I am permitted to notice as follows : –

Spilogale angustifrons celeris, subsp. n.

Type.—Male, adult, skin with skull ; B.M. no. 3.2.1.8 ; San Isidro, Costa Rica, February 4, 1901 ; collected by C. F. Underwood.

Range.—Known only from the type-locality.

Diagnosis.—Size small and tail short (see measurements); white dorsal stripes only half the width of intervening black stripes or lateral white stripes ; tail with terminal fourth above and terminal two-thirds below white ; skull with small tympanic bullæ, anteriorly truncate glenoid processes, and relatively long postpalatal region.

Measurements.—The stuffed skins of the type and a young male topotype, B.M. no. 3.2.1.9, measure respectively : Total length 360, 379 ; length of tail 90, 120 mm. Bones of the hind feet are missing.

Comparisons.—*S. a. celeris* has as its nearest relative, both morphologically and geographically, *Spilogale angustifrons elata* Howell, previously known certainly only from the highlands of the State of Chiapas, Mexico. Relying on Howell's (North Amer. Fauna, no. 26, 1906) account of *elata* and two specimens from Duenas, Guatemala, referable to it, *celeris* is found to differ in narrower white stripes, absence of white spots on thighs, seemingly shorter tail, less inflated tympanic bullæ, and truncated, rather than anteriorly convex, glenoid processes.

Remarks.—The new race has special interest as being the southernmost known form of this genus, whose members are widely distributed over Mexico and most of the United States. As might be expected in a southern representative of a group otherwise of more northern occurrence, *celeris*, at near 10° N. latitude, lives in the mountains, and there probably finds for itself a climate in some respects similar to that of its northern relative, *Spilogale phenax olympica* Elliot, which, nearly 3000 miles away along the Canadian–United States Boundary, lives at sea-level.

In these small skunks a " developmental trend " from north to south is furnished by the shape of the ventral lip of the glenoid fossa. Whereas this lip, of the socket for reception of the articular condyle of the lower jaw,

Cranial Measurements in millimetres.

	Sex and age.	Basilar length.	Occipito-nasal length.	Zygomatic breadth.	Mastoidal breadth.	Interorbital breadth.	Palatilar length.	Post-palatal length.	Foramen magnum to plane of last molars.	Height of cranium.
Type, *celeris*, San Isidro, Costa Rica	♂ ad.	46·1	50·6	34·1	28·9	14·5	17·6	28·6	28·7	16·3
No. 3.2.1.9. : *celeris*, San Isidro, Costa Rica	♂ yg.	45·1	48·5	32·1	28·6	14·5	18·0	26·8	26·8	16·3
No. 75.2.27.9 : *elata*, Duenas, Guatemala	♂ ad.	45·9	47·8	34·0	28·7	14·8	18·3	27·9	27·8	17·0
No. 92.11.3.3 : *leucoparia*, San Diego, Texas	♂ ad.	48·5	51·8	40·1	34·3	17·3	19·1	29·5	29·4	18·6
No. 88.11.25.7 : *leucoparia*, San Diego, Texas	♀ ad.	44·9	45·7	32·7	28·9	15·6	18·5	26·3	26·3	16·3
Type, *pygmaea*, Sinaloa	♀ ad.	36·4	40·7	25·4	21·7	12·0	14·8	21·6	21·0	15·2
Type, *australis* (after Howell), Guerrero	♂ ad.	35·7	38·0	24·0	20·8	11·6	14·0	21·7	20·8	14·0

in the forms of most northern occurrence is convex on the forward margin and projects anteriorly to form a true process, it becomes to the southward progressively shorter and less convex, culminating in the truncated condition mentioned above as one differential feature of the Costa Rican animal. Indeed, we find in this feature evidence of intergradation between *celeris* and *elata*. The adult male skull, B.M no. 75.2.27.9, from Duenas, Guatemala, has the lip slightly convex anteriorly, and in this is intermediate structurally, as well as geographically, between *celeris* and *elata* , the latter has a definite, though much reduced, convexity of the glenoid process.

Another unusual feature of *celeris*, not observed in any other members of the genus, is the fenestration of the walls of the posterior nares. On the lateral wall of the interpterygoid space, at the junction of the palatine and interpterygoid bones, ossification is incomplete. The fenestrum is present on both sides in each of the two specimens examined. Additional individuals would be required to determine if this is more than an individual variation.

In his " Revision of the Skunks of the Genus *Spilogale* " (*op. cit.*) Howell recorded an imperfect specimen from Costa Rica, without definite locality data, under the name *Spilogale angustifrons elata*. Probably this is referable instead to *S. a. celeris*.

In employing the specific name *angustifrons* for the new race from Costa Rica account is taken of Howell's (*op. cit.*) names for the nearest relatives of *celeris*. However, as I recently pointed out (Carnegie Institution of Washington, Publ. No. 473, p. 55, 1936), when more complete material is available for study many of the kinds of *Spilogale* now treated as distinct species will almost certainly be found to intergrade, and may be more correctly arranged as subspecies of two or a few species. Then one of the earlier proposed names, possibly *Spilogale putorius* (Linnæus), will apply to the race newly named above.

Evidence in support of this view is provided by a pair of adult specimens in the collection of the British Museum (nos. 88.11.25.7 and 92.11.3.3) from San Diego, Texas, a place between the ranges, as known to Howell (*op. cit.*), of *Spilogale indianola*, *Spilogale leucoparia*, and *Spilogale ambigua*. The colour-pattern of the San Diego animal is almost identical with that of *leucoparia* (Howell, *op. cit.* pl. xi. fig. 3), except that the dorsal stripes are not joined to the lateral stripes, being instead separated by an intervening black area 17 mm. in extent, and that the postero-dorsal stripe extending down over the hinder back and flank is even better developed than in *leucoparia*. In colour then the animal at San Diego is most like *leucoparia*, and least like *indianola*, to which it likewise shows no special resemblance in shape of the skull. The skull, although flat interorbitally as in *leucoparia*, is more suggestive of *ambigua* in its great breadth (see table of measurements on p. 512) and relatively uninflated tympanic bullæ. Thus, although the specimens from San Diego can hardly be said to demonstrate intergradation, they do suggest it by combining the characters of two kinds of *Spilogale*, one of which occupies territory to the north-westward and the other to the westward.

In contrast to the several kinds of *Spilogale* mentioned above, which may prove to be only geographic races of a single species, *Spilogale pygmæa* Thomas appears to be a separate and distinct species. It was known from a single specimen taken at Rosario, Sinaloa, Mexico, until Howell (*op. cit.*) recorded a second one from Acapulco, Guerrero, Mexico, some 280 miles south-est of the type-locality. Now, with the type of *pygmæa* in hand, it is clear that the animal from Acapulco, although probably of the same species, belongs to another geographic race, which may be known as

Spilogale pygmæa australis, subsp. n.

Type.—Male, adult, skin with skull; U.S. Nat. Mus. no. 70581; Acapulco, Guerrero, Mexico; collected by E. W. Nelson and E. A. Goldman.

Range.—Known only from the type-locality.

Diagnosis.—Smallest known form of the genus; dorsal stripes continuous with those over hinder back; skull without sagittal crest; interpterygoid space spoon-shaped; palate short and not reaching posterior plane of last upper molars.

Measurements.—The type (after Howell) and the type of *S. p. pygmæa*, an adult female, have external measurements recorded by the collectors, respectively as follows :—

Total length 240, 250; length of tail vertebræ 72, 68; length of hind foot 33, 34 mm.

Comparison.—Selected differences of *australis* in comparison with *pygmæa* are a slight reduction in size of white areas, lesser size, less attenuated rostrum; more inflated tympanic bullæ, shorter palate, spoon-shaped rather than straight; almost parallel-sided interpterygoid space.

Remarks.—Additional specimens may show the difference in size between *australis* and *pygmæa* to be greater than first glance at the accompanying measurements suggests. Males of *Spilogale* are almost always larger than females; in length and breadth of skull they average 9 per cent. larger (see measurements for twenty races recorded by Howell, *op. cit.* pp. 36, 37). In the present instance, not only is *australis* the smaller of the two subspecies but the male of it is smaller even than the female of *pygmæa*.

LX.—*Studies on the Onychophora.*—VI. *The Life-history of* Peripatopsis. By S. M. Manton, M.A., Sc.D. (Mrs. J. P. Harding), Fellow of Girton College.

[Plate XIV.]

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Sedgwick (1885) and others have recorded keeping Onychophora alive for periods up to one year; growth has been observed, but full details of the life-history have not been obtained. Four species of *Peripatopsis* from Cape Colony have been kept in captivity in Cambridge for considerable periods. *P. moseleyi* and *P. sedgwicki* were the easier to maintain in health, some individuals living for nearly four years after their removal from Africa. *P. balfouri* and *P. capensis* lived less well, and stocks could not be maintained for more than two years.

Methods of Culture.

The animals were kept in closed glass tanks about 2 inches deep and filled with decaying wood from the

South African forests, their normal environment. *Peripatopsis* is carnivorous (Manton and Heatley, 1937) and is unable to digest vegetable food. The decaying wood supports an extensive micro-fauna, and this natural diet was supplemented by living and freshly killed woodlice and fresh sheep's liver twice a week. This food is not ideal; it is readily accepted by some individuals, but others persistently refuse to feed and die of starvation. They may do this as soon as they are captured or only after several years' captivity, and young ones born in the laboratory may feed normally for variable periods up to two years, and then starve themselves. *Peripatopsis* refused to eat termites, a food that is accepted by *Peripatoides* in Australia. The moisture of the tanks must be kept sufficiently high, but very wet surroundings are avoided by *Peripatopsis*, and they do not live well if kept too damp. The tanks were usually kept in darkness, as the animals always seek cover when exposed to daylight. Feeding normally takes place in dull light or darkness, and so conditions were provided for feeding at all times. The growth of fungi had to be checked sometimes. The tanks were opened twice a week for feeding and for occasional damping. Crowding was avoided in order to minimize transmission of fungal and coccidian parasites. The animals lived well at room-temperature, summer heat being avoided. A rise above 20° C. causes *Peripatopsis* to wander about as if seeking escape, but exposure to cold, provided the animals are not actually frozen, is not harmful. They have been collected in Africa from under stones and thin bark which were covered with frost at night.

GENERAL BEHAVIOUR.

Peripatopsis is very sensitive to light, and during the day will seek dark situations. If the animals are kept in darkness they will often remain in exposed situations, and can then be observed by means of a red light, to which they show no reactions. Under favourable conditions they may remain stationary in the same place for seven to ten days; they may then move about and feed, and again remain quiet or retire to a crevice. The frequency of feeding is very variable (Manton and Heatley, 1937).

When the animals are stationary in a closed tank the antennæ may be moved slightly. The creatures are very sensitive to air movements, and respond to them by seeking cover. The exposed sensory spines on the secondary papillæ of the body surface and the more crowded spines on the antennæ are all provided with nerves to their sensory capsules below the ectoderm (see Manton and Heatley, 1937, figs. 18 & 19). These spines are probably responsible for this sensitivity, and may be comparable with certain sensory hairs in insects which respond to air disturbances. The spines on the antennæ are also tactile. When the animals are walking the antennæ are sometimes brought in contact with the ground in front of the animal, and the substratum may be touched by these spines at intervals of about 8 mm.

There is a tendency for several individuals to remain near together or in close contact, and the young ones for some weeks are usually found either together or touching the adults (Pl. XIV. figs. 3 & 4), but this is not invariable. Zacher (1933) refers to the manifestation of parental care by *Peripatopsis* and also to a difference in behaviour of the two sexes towards the young. The behaviour of the four species of *Peripatopsis* which have been observed during several years captivity does not justify this interpretation. The tendency for individuals to remain together appears to be irrespective of age or sex or parentage. Young individuals show no recognition of their mother, and even adult males do not always correctly recognize the opposite sex, and will copulate with other males.

The sense of touch and the sensitivity to air movements is much more acute than is the sense of sight or smell in *Peripatopsis*. The eyes are very sensitive to sudden changes in intensity of illumination, but no evidence could be obtained of an image being perceived. Feeding and copulation are carried out independently of sight, and the animals are not dependent upon light for finding either food or a mate. Movements of objects close to *Peripatopsis* evoke no response unless accompanied by air movements.

No evidence has been obtained of the animals having an acute sense of smell. When hungry individuals are provided with meat they do not walk directly to it but reach the meat by accidental contact with it in the course of their wanderings. Food is usually touched repeatedly by the sensory spines of the antennæ before it is brought in contact with the oral sensory organs, but the nature of the sensations perceived by the antennæ is unknown. The chemo-sensory organs of the lips and oral cavity and the manner of their utilization has already been described (Manton and Heatley, 1937), together with the feeding mechanism.

Sedgwick (1885) records the presence of spermatophores on *Peripatopsis* from June till January. The actual deposition of spermatophores has now been observed in *P. sedgwicki* by the use of a red light, which does not stimulate the animals as does a white light. A male animal in walking over another individual holds the body between all the paired legs which are in contact with it, and spermatophores are then deposited anywhere on the upper or lateral surfaces of the trunk and legs. Usually spermatophores are deposited on females, but occasionally they are placed also on males. As many as 180 spermatophores are deposited on one female during a fortnight. Each spermatophore is roundish but irregular in shape, and is usually about 200 μ across. They may be deposited at intervals of not more than 100 μ. The subsequent penetration by the spermatozoa through the body-wall and the passage to the ovary has been described (Manton, 1938).

ECDYSIS.

It is well known that the Onychophora moult at intervals and that the cast skin is usually eaten. The process has been described by Steel (1896) and others, and there are many figures showing the mid-dorsal line of weakness in the integument, which is here devoid of papillæ, and the split occurs here when the skin is shed (ex. Bouvier, 1905). The frequency of ecdysis has been reported as occurring " at apparently somewhat irregular intervals " (Steel, 1896).

At ecdysis the lining of the long rectum and of the oral cavity, pharynx, and œsophagus, together with the jaw endoskeleton, are removed. Analysis of the cast skin shows it to contain protein as well as chitin, and this protein is digested when the animal eats the cast skin.

A number of animals have been kept in isolation, and were inspected frequently in order to record their ecdyses. Since the skin is frequently eaten at once inspection at three- to four-hourly intervals was necessary for ecdysis to be observed. In ten out of fourteen cases of normal ecdysis the process took place about a fortnight after the previous ecdysis, as shown in the table. No healthy animal was observed to cast its skin more frequently than every thirteen days. Only one individual was watched for a prolonged period (see Manton and Heatley, 1937, fig. 13), and here the intervals between ecdyses were fourteen, eighteen, thirteen, and fifteen days respectively. Another specimen cast its skin after two successive periods of fourteen days.

Intervals in days between successive ecdyses.							
	7.	13.	14.	15.	17.	18.	20.
Number of examples recorded.	1 (dying)	4	3	3	1	1	1

The first ecdysis takes place before birth. The stretched egg-membrane, which is secreted by the upper oviduct and encloses the developing embryo, breaks some weeks before birth (see Manton, 1938). The first ecdysis takes place after this event and at about the same time as the first peritrophic membrane with contained uric acid crystals is passed out of the body (Manton and Heatley, 1937). The cast egg-membrane, the peritrophic membrane, and the cast integument remain in the oviduct until the birth of the young, when all are evacuated.

It is probable that ecdysis takes place throughout life. A number of full-sized specimens died after a few weeks or months of captivity, and it was believed that they died of old age rather than owing to malnutrition or disease. They cast their skins not long before they died with one exception. A female *P. sedgwicki*, which was at least six years old and had been in captivity for over three years, was watched at four-hourly intervals throughout five weeks, and less frequently during the succeeding fortnight, at the end of which it died. No ecdysis took place during these seven weeks, and the same spermatophores were seen on its surface throughout this period (spermatophores are always removed at ecdysis).

Premature death may be caused by disease (see below) or starvation, and such enfeebled animals frequently die at ecdysis. The old integument becomes partially separated from the new underlying one, but the animal is unable to rid itself of the old skin and dies possibly of suffocation.

The occurrence of ecdysis at fairly regular intervals throughout life is not necessitated by growth. Increase in size may be continuous throughout life, although it is very slow, if it indeed takes place, in later years. The small amount of growth taking place in fourteen days, even in a young animal, is unlikely to necessitate a larger skin. Both body-wall and integument are very elastic, and the soft flexible cast skin when floated on to water usually exceeds by one-third the length of the animal from which it came.

LIFE-CYCLE.

The sequence of events of the life-cycle, their duration, and the growth-rate have been deduced from observations made on captive animals and from the examination of wild populations. Although animals in captivity lived for nearly four years their appetites were on the whole below normal; consequently the growth of such specimens was slower than in the wild state. No young were born from animals captive for more than nine months or from those which were born in the laboratory. Embryos in such animals were at first normal, but during the last few months of pregnancy they failed to grow, died, and were then partly absorbed. This condition was associated with scanty food reserves in the parent, and was undoubtedly due to underfeeding.

The breeding season of *Peripatopsis* is much more uniform throughout members of some species than it is in others. Sedgwick records fertilized eggs in *P. capensis* passing into the oviduct in April, and the same is true for *P. balfouri*. The earliest segmentation stages of *P. sedgwicki* were found in January and at the beginning of March in specimens collected near Knysna and near the mouth of the Groot River respectively, while those of *P. moseleyi* from the Hog's Back near Alice occurred at the end of March. Similarly the birth of young *P. capensis* and *P. balfouri* takes place over a few weeks in May and early June on the Cape Peninsula, while those of *P. sedgwicki* from Knysna and from near Grahamstown and *P. moseleyi* from the Hog's Back were born throughout a longer period from July till December, the majority being born before mid-October. Purcell (1900) records *P. moseleyi* from Natal giving birth to young in April. Thus the breeding season in *P. capensis* and *P. balfouri* is restricted to a few weeks, while that of *P. moseleyi* and *P. sedgwicki* covers many months. The periodicity of breeding and related phenomena in the species of *Peripatopsis* collected in 1933 does not appear to have been changed by their transference to the northern hemisphere, but as the animals have been kept at room-temperature they have not experienced fully the seasonal climatic changes. Figs. 3 and 4 (Pl. XIV.) show different colour-varieties of *P. moseleyi* and young ones a few weeks old. I am indebted to Mr. D. P. Wilson for taking the photographs.

The development of ripe ova from oogonia in the ovary has been described (Manton, 1938). The growth of one ovum occupies a variable period not exceeding twelve months. Fertilization occurs in the lumen of the ovary just before the ova pass into the oviduct. That this event first takes place about one year after birth is evident from two sets of observations. (1) Some young *P. moseleyi* were born and reared in the laboratory, and therefore their ages were known. The males became sexually mature at the age of nine to eleven months, and started to copulate with females of the same age. Only one of these females was kept for long, and was killed at the age of 2 years 2 months. While the upper oviducts contained early segmentation stages derived from eggs which must have just left the ovary, the lower oviduct on one side contained a single large "outer" egg-membrane (see Manton, 1938) within which was a mass of disorganized material in the process of absorption. This abortive embryo must have been developed from an ovum fertilized a year previously, when the animal was just over 12 months old. (2) Females of *P. balfouri* from the smallest size group of the wild population (other than recently born individuals) were killed in June. These animals were probably a little over a year old, and they contained young segmentation stages which had just passed into the lower oviduct. Thus in this species also fertilization of the first batch of eggs had occurred at the end of the first year.

It is well known that embryonic development in *Peripatopsis* takes about thirteen months. Thus females will give birth to their first batch of young when they are about two years old in species such as *P. capensis*, *P. balfouri*, *P. sedgwicki*, and *P. moseleyi*, where all embryos are of about the same age. Fertilization of the next batch of eggs takes place at least one month before the previous embryos are born. Breeding in *Peripatopsis* continues throughout life, and all females over one year of age normally carry developmental stages.

Little information has previously been obtained on the rate of growth or length of life of *Peripatus*. Steel (1896) kept the Australian *P. leuckarti* in captivity long enough for some growth to be seen, but no observations have been made on the whole life-cycle.

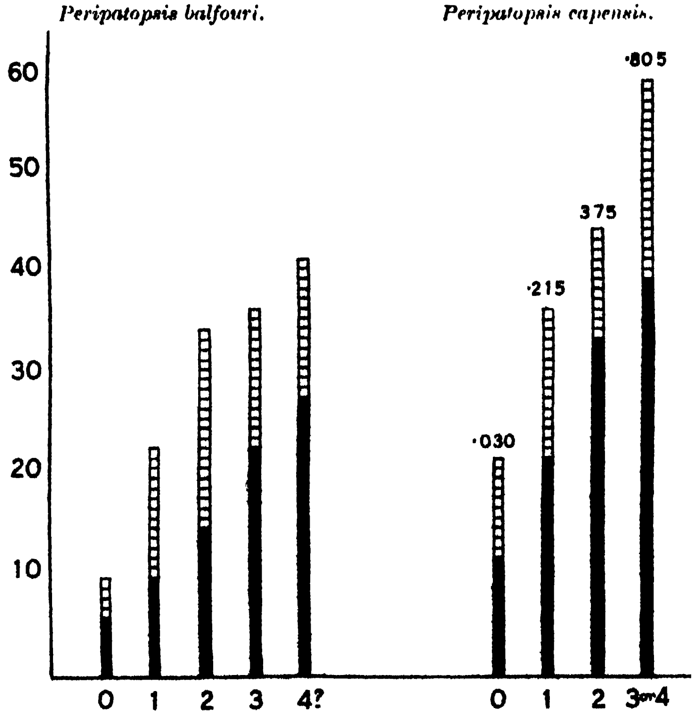
P. balfouri did not live as well as the other species in captivity, and most of the young ones failed to grow up. *P. capensis* thrived better; individuals which were full-sized when captured died at the end of a year's captivity, probably of old age, and two of their offspring grew up normally and became sexually mature, but after two years of age they refused to feed and died. *P. moseleyi* and *P. sedgwicki* lived in captivity for nearly four years, and young ones born in captivity became sexually mature and nearly full-sized before they were killed for various purposes.

Maximum size is not reached until the end of the third year at the earliest, possibly not till the fourth year, but a normal size is only achieved after sufficient feeding. When full size is attained the animals live for at least another three years, during which growth, if any, is slight. Possibly they may live longer, but the available evidence indicates that they usually do not. Thus *Peripatopsis* has a life span of at least six or seven years. The only estimate made previously of the length of life seems to be for *Peripatoides* by Steel (1896), who suggested a minimum of three years.

The size of *Peripatopsis* is difficult to measure accurately. Linear dimensions of living animals depend on the degree of extension of the body. Dead specimens killed with chloroform may be abnormally contracted, while those killed by drowning may be greatly distended. The cast skin of a 60 mm. *P. capensis* when floated on to water measured 90 mm., and it is probable that drowned specimens may similarly increase their linear dimensions by at least one-third. Such enlarged specimens are frequent in museums. The weight also is an uncertain measure, as it may vary up to at least 30 per cent. according to the dampness of the environment, and in females the proportion of body-weight to that of the embryos depends on the time of year and on the number of embryos in the oviducts. Fig. 1 (p. 524) shows an attempt to present some measure of the size of normally fed females of *P. balfouri* and *P. capensis* at various ages. Males are a little smaller than females. The whole columns represent the length of the body (excluding antennæ) of living animals extended for walking, and the black parts indicate the length of the same animals when contracted. New-born animals are marked "0 years," and the figures over the columns for *P. capensis* represent their weights in grams. Possibly the three-year old *P. balfouri* was under the maximum size for that age, but the three- or four-year old *P. capensis* represents a normal full-sized specimen. Purcell (1899) records 43 mm. and 58 mm. respectively for the length of average full-sized *P. balfouri* and *P. capensis* females when living and extended, and these measurements agree with those recorded here for specimens not less than three years old. Thus it is evident that maximum size in well-fed *Peripatopsis* is reached in about three years, and after this growth is either slow or ceases.

Steel (1896) queried the possibility of large *Peripatus* becoming smaller in size as a result of starvation or unfavourable conditions. No confirmation of this suggestion has been obtained from *Peripatopsis* specimens which have refused to feed for months at a time. No general reduction in size occurred in these individuals. They became thin owing to the depletion of food reserves in the intestine (see Manton and Heatley, 1937), but the length of the body did not materially decrease although the width did so owing to the sagging of the body-wall round the shrunken viscera.

Fig. 1.



The length of two species of *Peripatopsis* at different ages in the living state is represented by the columns. The whole columns show the length of the animals when extended for walking, and the black parts show the length of the same specimens when contracted.

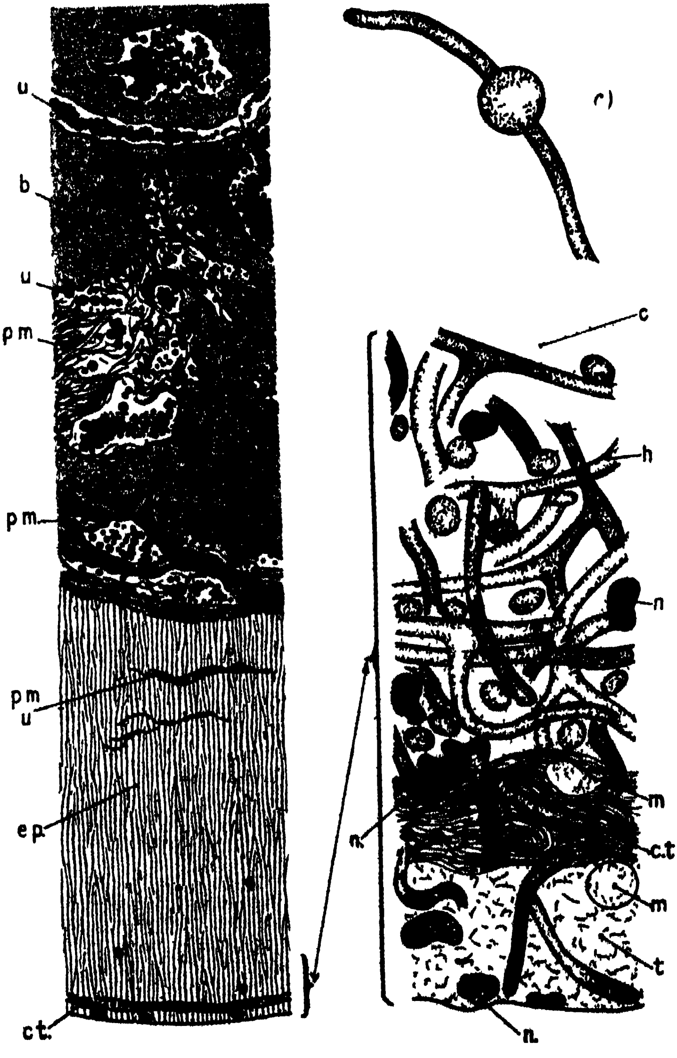
ABNORMAL AND DISEASED CONDITIONS.

In captivity *Peripatopsis* has suffered from several diseased states, all affecting the alimentary canal. It has been noted (Manton and Heatley, 1937) that the lumen of the intestine is normally sterile owing to the daily removal of the entire peritrophic membrane. The intestinal epithelium, however, may be infested with micro-organisms or it may show a pathological condition which leads to death. As the intestine is not only the digestive organ but also the site of nitrogenous excretion and storage of reserve food material, abnormal conditions of this organ are of great physiological importance.

A coccidian parasite, *Mantonella peripati*, may be found in the columnar epithelial cells of the intestine. Both genus and species have been described by Vincent (1936), and a second species of the same genus has been recorded from a crayfish in a south Russian river by Gousseff (1936). A large proportion of the local populations of all species of *Peripatopsis* examined were infected with this parasite. In small numbers it does not appear harmful, but when the infection is heavy the host appears to suffer, and many animals dying in captivity possessed abundant coccidia throughout the whole intestinal epithelium. Mitoses of the epithelial cells may be induced by the parasite ; normally cell-division is restricted to the basal regenerative cells. The sporocysts of *Mantonella* pass into the lumen of the intestine and are removed within twenty-four hours by the next outgoing peritrophic membrane. In the normal damp surroundings of *Peripatopsis* the sporocysts live for considerable periods, and reinfection presumably takes place by the mouth.

An intestinal fungus was a much more lethal parasite than the coccidian and caused many deaths in captive animals. The hyphæ are intracellular and permeate the whole intestinal wall, entering even the nuclei of the component cells. Round spores pass into the intestinal lumen, and in cases of mild infection are removed by the next peritrophic membrane. Spores have often been seen to produce hyphal threads inside the evacuated peritrophic membranes (fig. 2 (*c*)). The effects of a heavy infection of this fungus are quite devastating, the intestinal wall becoming distended and its component cells and muscles disorganized and destroyed. The tracheæ in the outer connective tissue sheath also disappear. The peritrophic membranes are formed but not removed, and thus the lumen of the intestine becomes filled with chitinous lamellæ and layers of uric acid

Fig 2



(*a*) (*b*)

Sections in intestine of *Peripatopsis* infected with a parasitic fungus.

(*a*) Part of transverse section showing a wedge from the middle of the lumen to the outside Compare with the normal condition shown in figs 6, 11, and 15, Manton and Heatley, 1937. The epithelium is disorganized and the lumen distended with crystals, and a heavy bacterial infection replaces the normal sterile condition. Death finally ensues. Figs. 2 (*a*) & (*b*) show the appearance of a heavily infected intestine in section. The animal probably could not have lived for much longer. Fig. 2 *b*) shows the detail of the condition of the epithelium. Comparison may be made with the appearance of the normal intestine shown in figs. 6, 11, & 15 in Manton and Heatley, 1937.

A pathological fatty condition leading to death has been found in many animals which were believed to have reached the end of their normal life span. It also occurred in some younger animals which were not in a healthy state or which were on the verge of death. The intestine of such animals was devoid of the normal protein and glycogen reserves (see Manton and Heatley, 1937), but contained abundant fat. The intestine appeared whitish instead of the usual brown colour, and analysis yielded the almost incredible figure of 50 per cent. of the wet weight as fat (estimated by N. G. Heatley). The intestine in section after solution of the fat shows the cytoplasm to be extremely vacuolated; the normal appearance of the epithelium is seen in Manton and Heatley, 1937, pl. xxxviii. The cause of this condition is unknown. It is sometimes associated with the formation and removal of four or five peritrophic membranes a day instead of the normal single membrane. The animals became feeble and were ultimately unable to rid themselves of their skins at ecdysis, and so died.

Some animals show microsporidia scattered through the muscles, epithelia, and sense-organs, but no adverse

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accumulated peritrophic membranes, uric acid crystals, and bacteria. × 220.

(*b*) Outer portion of the intestinal wall. The connective tissue layer contains no tracheæ and its muscles are few and degenerating, the epithelial cells are broken down to an amorphous mass with occasional distorted nuclei, and fungus hyphæ permeate the whole. × 1675.

(*c*) Growing hypha from an evacuated peritrophic membrane.

b., bacteria; *c.*, cytoplasm of disorganized intestinal epithelial cells; *c.t.*, connective tissue layer; *e.p.*, disorganized intestinal epithelial cells infested with fungus hyphæ; *h.*, hyphæ of fungus; *m.*, remains of a muscle-fibre; *n.*, degenerating nucleus; *p.m.*, peritrophic membranes; *u.*, uric acid crystals.

effects seem to be caused by these organisms. For the Australian Onychophora Steel (1896) remarks "I have never noticed the presence of external parasites of any kind on *Peripatus*." A similar statement may be made for the hundreds of specimens of South African *Peripatopsis* which have been handled in selecting material for this series of studies.

SUMMARY.

(1) Species of *Peripatopsis* have been kept in captivity for nearly four years since their removal from South Africa. The methods of culture are described.

(2) Notes are given on the general behaviour of *Peripatopsis* concerning their reactions to one another, and their senses of touch, sight, smell, and their sensitivity to air movements.

(3) The occurrence and frequency of ecdysis is recorded.

(4) The sequence of events in the life-cycle, their duration, and the growth-rate are described. Full size is attained at the age of three or four years, and the animals live for at least a further three years.

(5) The effects of a lethal parasitic fungus, a coccidian, and a pathological state not associated with micro-organisms is recorded.

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EXPLANATION OF PLATE XIV.

Photographs of living *P. moseleyi* by D. P. Wilson.

Fig. 3. Full-grown dark grey female and young a few weeks old, with a lighter grey partly grown female.

Fig. 4. Full-grown light grey female and young a few weeks old, and a bluish-black partly grown specimen.

LXI.—*Notes on Insects collected in West Greenland by the Oxford University Greenland Expedition*, 1936. By G. D. HALE CARPENTER, D.M., Hope Professor of Zoology (Entomology) in the University. *With Descriptions of a new Species of* Angitia (*Hymenoptera*, Ichneumonidæ) *by* A. ROMAN, *and of* Fannia (*Diptera*, Anthomyidæ) *by* J. E. COLLIN.

A GENERAL account of the expedition will be found in the 'Geographical Journal' for October 1937 (xc. pp. 315–326): a section on Terrestrial Ecology by H. G. Vevers, who collected most of the terrestrial Arthropoda, occupies pp. 329–331, and a section on Marine Ecology is written (pp. 331–332) by D. M. Steven, who collected along the shore: specimens from him are distinguished by D.M.S. in the records. The area concerned is the neighbourhood of the head of Søndre Strømfjord, and Amerdloq Fjord running inland from the coast at the same latitude (67°). One month was spent at Camp Lloyd on Søndre Strømfjord, for brevity's sake referred to as (L.), which is in the continental hilly belt about 24 miles from the Inland Ice at the head of the Fjord. Five weeks were spent at Utorkait (U.) on the Amerdloq Fjord, in the coastal mountainous region, 15 miles east of Holsteinsborg, and near the northern limit of the maritime Arctic climatic régime distinguished by Trapnell.

Careful notes accompanied the specimens, and in order to avoid repeating the minor details they are listed here so that subsequent reference will be by abbreviations.

Utorkait (U.).

C. Heathland at camp, about sea-level.
Mr. Moorland heath, near lake.
Mt. Top of moraine, moraine heath.
W. Willow scrub.
P_1. Pools ½ mile from shore-line, about 500 feet elevation.

Camp Lloyd (L.).

G. Grassland on silt moraine.
H. Heathland other than silt moraine.
W. Willow scrub.
P_2. Pools one mile from shore-line, about 1000 feet elevation.

The specimens here described were presented by the Exploration Club to the Department of Entomology in the University Museum, where they are kept together with other Arctic collections. The identifications have been done by experts in the different groups, to whom warm thanks are given for their kind help: names are in alphabetical order. F. Balfour-Browne; K. G. Blair; J. M. Brown; W. E. China; J. E. Collin; F. W. Edwards; Ch. Ferrière; H. Hedicke; Karl Jordan; F. J. Killington; F. Laing; E. Meyrick; M. Mosely; L. B. Prout; A. Roman; H. Stringer; W. H. T. Tams.

An endeavour has been made to establish the novelty of certain records for West Greenland. Dr. B. M. Hobby, librarian and assistant to the Professor, gave great assistance by searching for references to Greenland fauna in the 'Zoological Record' back to 1900, and I myself looked through the papers thus found. The following 22 names therefore appear to be new records for West Greenland, and are distinguished by * throughout the paper. The order of classification of the families considered is in accordance with Imms's 'Text-book of Entomology,' third edition, 1934.

NEW RECORDS.

APHIDIDÆ: *Phenacococcus venustus* Green.
HEMEROBIIDÆ: *Hemerobius* sp. ? *perelegans* Steph.
LIMNOPHILIDÆ: *Limnophilus ornatus* Bankes.

GELECHIIDÆ : *Phthorimæa charcoti* Meyr.
EUCOSMIDÆ : *Eucosma petalonota* Meyrick, 1937.
TORTRICIDÆ : *Peronea caryosphena* Meyrick, 1937.
LATHRIDIIDÆ : *Corticaria linearis* Payk.
ICHNEUMONIDÆ : *Craticheumon magus* W. (*clavipes* Moll.).
Phygadeuon sp.
Aniseres lubricus Foerst.
Angitia (*Inareolata*) *laticepus*, sp. n., Roman.
ENCYRTIDÆ : *Microterys tessellatus* Dalm.
PTEROMALIDÆ : *Habrocytus* sp. (genus not previously recorded).
FIGITIDÆ : *Anacharis eucharioides* Dalm.
MYCETOPHILIDÆ : *Sciara consimilis* (Holmgr.) Edw.
Sciara (*Scatopsciara*) *vivida* Winn.
AGROMYZIDÆ : *Liriomyza* sp. nr. *perpusilla* Mg. (genus not previously recorded).
Phytomyza ? *nigra* Mg.
ANTHOMYIDÆ : *Graphomyia picta* Ztt.
Phaonia pallidisquama Ztt.
Fannia bifimbriata, sp. n., Collin.
CERATOPHYLLIDÆ : *Ceratophyllus borealis* Rthsch.

THYSANURA.

Several specimens were sent to Dr. J. Douglas Hood at Rochester University, New York, but he has, unfortunately, not found himself able either to return the specimens or to forward identifications.

COLLEMBOLA.

An account of the Collembola was included by J. M. Brown in his paper "On some Collembola from Iceland and Greenland" in 'Annals and Magazine of Natural History,' (10) xx. pp. 514–520 (1937). His arrangement is here followed, but only names and localities are given.

ARTHROPLEONA

Hypogastruridæ.

Xenylla humicola (O. Fabr.) Tullb.

U. D. M. Steven, numerous specimens.

Onychiuridæ.

Onychiurus arnatus var. *arcticus* (Tullb.).

L. Three specimens.

Isotomidæ.

Folsomia quadrioculata (Tullb.).

L. Two specimens.

Archisotoma besselsi (Pack.).

L. Numerous specimens from silt along the shore at head of fjord, D.M.S.

Entomobryidæ.

Lepidocyrtus cyaneus Tullb.

U. One specimen.

HEMIPTERA.

HETEROPTERA.

Lygæidæ.

Nysius grœnlandicus Zett.

U., Mr. ♂ and ♀ adults on lichens and *B. nana*, 26. vi.
U., Mr. 1 larva on lichen, 26. vi.
U., Mt. 2 larvæ on moraine gravel, 1. vii.
U., Mt. 1 larva on sand, 3. vii.
U., C. Larvæ common on *B. nana*, 2. vii.
U., C. ♂ and ♀ adults on *B. nana*, 2. vii.
U., C. 1 larva on grass-blades, 18. vii.
U., C. Larvæ from sweep of *B. nana*, 19. vii.
L., G. ♂ and ♀ adults mating in grass, 18. viii.

Capsidæ.

Chlamydatus pulicarius (Fall.).

U., Mr. 1 larva on *B. nana* and lichens, 26. vi.
U., Mt. 1 larva on sand, 3. vii.
U., Mt. 2 larvæ from sweep of *B. nana*, undated.

HOMOPTERA.

Jassidæ.

Deltocephalus lividellus (Zett.)

U., Mr. 1 adult on *B. nana* and lichens, 26. vi.
U., C. 1 adult from sweep of *B. nana*, 19. vii.

L., W. 8 adults from sweep of sedge and grass, or under Ptarmigan droppings, 11. viii. 7 adults from sweep of grass, 13. viii.

Psyllidæ.

A number of Psyllidæ were reported upon as follows by Dr. Laing:—"They appear to belong to one species *Psyllia dudai* Sulc, but there is confusion between *nigrita*, *salicicola*, *saliceti*, *dudai*, and allied species."

Aphididæ.

Myzocallis minimus V. d. G.

U., Mt. Immature, from sweep of *B. nana*, birch-lichen mat.

U., Mr. Immature, on *B. nana* and lichens, 26. vi.

I have not found any published record of this species from Greenland, but Dr. F. Laing kindly informs me that "it has turned up in material collected there from time to time."

**Phenacococcus venustus* Green.

L., W. Under Ptarmigan dropping, 1 specimen, 11. viii.

Dr. F. Laing writes: "This specimen, although antennæ are incomplete, I have assigned to *Phenacococcus venustus* Green, known only from Iceland."

Tychæa grœnlandica Rübs.

L., W. 1 specimen, in soil and moss, 11. viii.

Dr. F. Laing writes: "The specimen may remain under this name, but it is quite plainly a Pemphigid, and the name *Tychæa* will not, of course, stand. Until a longer series becomes available for study the status of the species will remain unknown."

Myzus sp. ?

Apterous viviparous ♀.

U., C. 15. vii.

Dr. F. Laing writes: "The specimen is not good, but belongs evidently to the *convolvuli* group."

Coccidæ.

Orthezia cataphracta Shaw.

U., C. On roots of *Chamænarium*, 13. vii.

NEUROPTERA.

Hemerobiidæ.

**Hemerobius* sp. ? *perelegans* Steph.

L., W. On *Salix*, 11. viii.

Mr. F. J. Killington was unable to assign this single specimen, a female, with certainty to *perelegans*, of which he stated in his "Monograph of the British Neuroptera" (Ray Society, ii. p. 17, 1937) that "Abroad this species is at present known only from one or two localities in Sweden."

Kimminsia (*Boriomyia*) *betulina* (Strøm.).

U., Mt. ♂ 1. Swept from *B. nana*, birch-lichen mat, 28. vi.

U., W. ♂ 1. Swept from top layer of willow scrub, 1. vii.

U., W. ♂♂ 2. Flying over willow scrub, 10. vii.

Killington (*loc. cit.* p. 89) mentions that the Oxford University Museum possesses "a specimen taken in west Greenland (G. Hingston)." There are actually ♂♂ 2, ♀♀ 5, Godthaab Fjord, Kugssuk and Matuola, between 7th and 28th July, 1928, taken by R. W. G. Hingston.

TRICHOPTERA.

Limnophilidæ.

**Limnophilus ornatus* Bankes.

U. 1, on *Empetrum* moor, 14. vii.

The specimen has been presented to the British Museum (Nat. Hist.) as a new record for Greenland. Mr. M. Mosely kindly informs me that this species, closely related to the British *L. elegans*, has been recorded from Canada, Alaska, Franconia (N.H.), and Japan.

Apatania arctica Bohem.

U., C. 1, on *B. nana*, 15. vii.

LEPIDOPTERA.

TINEOIDEA.

Gelechiidæ.

**Phthorimæa charcoti* Meyr.

U., Mt. 3, on *Salix* in birch-lichen mat, 3. vii.

TORTRICOIDEA.

Eucosmidæ.

**Eucosma petalonota* Meyrick, 1937.

L., G. ♀ 1, on *B. nana* and *Salix*, 18. viii.
L., H. ♀ 1, on *B. nana*, 18. viii., ♂♂ 3, 24. viii.

These are the specimens on which Meyrick based his description of the species ('Exotic Microlepidoptera,' 1937, v. p. 157; but "3 ex. (Oxf. Mus.)" should read "5 ex. (Oxf. Mus.)").

Tortricidæ.

**Peronea caryosphena* Meyrick, 1937.

L., G. ♂ 1, on *B. nana* and *Salix*, 18. viii.
L., H. ♂ 1, on *B. nana*, 18. viii.

The specimens on which Meyrick based his description (*loc. cit.*).

PYRALOIDEA.

Phycitidæ.

Laodamia fusca Haw.

U., Mr. 1, on *B. nana*, 18. vii.

Pyraustidæ.

Scoparia centuriella F.

U., W. 1, on *Salix*, 15. vii.
U., Mt. 1, on *B. nana* or *Salix*, birch-lichen mat, 15. vii.
U., W. 1, on *Salix*, 17. vii.

PAPILIONOIDEA.

Nymphalidæ.

Brenthis chariclea arctica Zett.

U. 2, 16. vii.
U., Mr. 4, herb mat, 18. vii.
U., C. 1, visiting *Vaccinium* flowers, 10. vii.
U., Mr. 3, *Empetrum*-birch moor and herb mat, 21. vii.
U., Mr. 2, *Cassiope-Empetrum* mat, *c.* 1000 feet, 21. vii.

U. 1, 22. vii. The right hind wing noted before capture to have its posterior two-thirds missing. The injury suggests the work of a bird.

Pieridæ.

Colias hecla Lef.

U., Mr. 1, *Cassiope-Empetrum* mat, c. 1000 feet, 7. vii.
U., Mr. 2, *Empetrum*-birch moor and herb mat, 21. vii.

GEOMETROIDEA.

Geometridæ.

Entephria polata punctipes Curtis.

U., Mr. 1, *Empetrum*-birch moor and herb. mat, 21. vii.

A rather weakly-marked dark female, approaching ab. *brullei* Lef. All specimens of this species in the University collections from the Arctic were submitted to Mr. L. B. Prout in March 1937, and he kindly allows me to give his views, as follows:—"No definite line can be drawn between the various high-northern forms, though there is, as with most Palæarctic and Nearctic Larantiidæ, considerable variation. There seems to be a tendency for the species to form two ill-defined races: (*a*) *E. polata polata* Dup. (1831), from Scandinavia, parts of N. Russia, etc.; (*b*) *E. polata punctipes* Curt. (1835), founded on a single damaged example brought from Ross's second Arctic expedition, the exact locality for which is unknown, but the form is distributed in Greenland and Arctic America. Of this I must call *brullei* Lefebvre (1836) an 'ab.' or 'ab. loc.,' founded also, probably, on a single specimen, though this is not stated: this was from the 'Pays des Esquimaux.' This form is dark and glossy, rather pointed-winged, the median band either weakly expressed or virtually wanting, as in the nominotypical specimen. Glancing over the whole material again I do notice a tendency for the Greenland forms to be a trifle darker, perhaps particularly on the hind wing, than those from N.E. Baffin Land, but I see no likelihood of reverting to a belief in two differentiable races of *polata*."

Eupithecia gelidata Möschl.

All from Utorkait.

Mt. 7, on *B. nana*, moraine heath, birch-lichen mat, 28. vi.

Mt. 1, on *Salix*, 28. vi.

Mr. 4, on *B. nana* and *Salix*, 29. vi.
C. 1, on *B. nana*, 30. vi.
W. 2, swept from top layer, 1. vii.
W. 1, from "shrub layer," 2. vii.; also 1 of same date, no details.
Mr. 2, on *B. nana*, 10. vii.
Mr. 1, hovering over female *Salix*, 13. vii.
Mr. 1, *Empetrum*-birch moor and herb mat, 21. vii.
Mr. 1, common on *Salix*, 22. vii.

NOCTUOIDEA.

Noctuidæ.

Crymodes exulis Lef.
U. 1, flying by day over *Salix*, 13. vii.

Anarta richardsoni Curt.

U., Mt. 1, sweeping from *B. nana*, birch-lichen mat, sample 5, 5. vii.

Eurois occulta L.

L., G. 4, flying at night, 9. viii.

Epipsilia quadrangula Ztt.

L., G. 2, flying at night, 9. viii.; 1, ditto, 11. viii.

Eumichtis sommeri Led.

L., G. 2, flying at night, 9. viii.

Simpistis zetterstedtii Staud.

U., Mr. 1, from *B. nana* or *Empetrum*, 18. vii.

COLEOPTERA.

ADEPHAGA.

Dytiscidæ.

Hydroporus morio (Dej.) Aubé.

L., P_2. 4, 23 & 27. vi., D.M.S.
U, P_1. 3, 20–22. vii., D.M.S.

Colymbetes dolabratus Payk.

L, P_2. 2, 23 & 27. vi., D.M.S.
U., P_1. 3, 20–22. vii., D.M.S., with three larvæ.

Gyrinidæ.

Gyrinus opacus Sahl.

L., P_2. 4, 23 & 27. vi., D.M.S.
U., P_1. 4, 20–22. vii., D.M.S.

POLYPHAGA.

DIVERSICORNIA.

Lathridiidæ.

**Corticaria linearis* Payk.

L., G. 1, in soil, moss, and silt, 9. viii.

Dr. K. G. Blair, who kindly identified the specimen, wrote that it "occurs in Siberia, but has not been recorded from Iceland, Greenland, or North America."

Coccinellidæ.

Coccinella transversoguttata Fld.

U., Mt. 1, on *B. nana*, birch-lichen mat, 10. vii.
L., H. 1, on *B. nana*, 24. viii.

Byrrhidæ.

Byrrhus fasciatus Forst.

U., C. 1, under stone, 20. vii.

RHYNCHOPHORA.

Curculionidæ.

Otiorrhynchus nodosus O. Fab.

U., C. 2, in soil, under stones, and on *B. nana*, 2. vii. and 5. vii.

HYMENOPTERA.

APOCRITA.

ICHNEUMONOIDEA.

Ichneumonidæ.

ICHNEUMONINÆ.

**Cratichneumon magus* W. (*clavipes* Möll.).

U., W. ♂ 1, by sweep of shrub layer, 14. vii.
U., C. ♀ 1, visiting *B. nana*, 21. vii.

Dr. A. Roman, who kindly identified the Ichneumonoidea, reported.—"The two are small (♀ 5·5 mm., ♂ 6 mm.) and dark. Antennæ of ♀ with no white ring, face of ♂ black with two yellow points near the lower facial angles and two more just below antennal bases, scutellum black. This species has not previously been recorded from Greenland; the southernmost locality for it seems to be somewhere in France, according to the catalogue of de Gaulle (probably in a mountainous part) In Scandinavia it goes down to our southernmost province, Scania, as *clavipes* Möll, the type of which I have seen in the museum of Gothenburg. It is everywhere a rare species."

CRYPTINÆ.

Cryptus arcticus Schdte.

U., Mt. ♂ 1, on birch-lichen mat, 27. vi.

"A common species on all the Greenland coast. Not found in Europe"

Phygadeuon cylindraceus Rthe.

U., C. ♂ 1, field layer, 14. vii.
U., C. ♂ 2, visiting *B. nana*, 20. vii.

"Common North European coast species, but occurring also in the Scandinavian mountains. I have seen a ♀ of probably this species from the Austrian Alps (collector, L. Czerny)."

Phygadeuon, sp. A.

U., W. ♂ 1, sweeping of grass, 10. vii.
L., W. ♂ 1, sweeping of grass, 13. viii.

"Seems to be the species reported by me in 1930 (Ann. & Mag. Nat. Hist. (10) v. p. 283) as a single male from Matuola in W. Greenland, July 3rd. At least the characters given in that report fit these specimens, excepting that the stigma emits radius before its centre, but so little that it may fall within the specific amplitude."

**Phygadeuon*, sp. B.

L., W. ♂ 1, sweeping of grass, 13. viii.

"A small specimen of 3·3 mm. length with a rather thick head, not narrowed behind the eyes, but with rounded sides; clypeus with two marginal granules.

Antennæ thinner than in the last species, which it much resembles in colour and most other characters. Both hind wings are missing." Dr. Roman considers this species new to Greenland.

Gelis terebrator Ratz.

U. ♀ 1, 10. vii.

"Rather common, but the only species known from Greenland."

Pimplinæ.

Pimplidea sodalis Rthe.

U., Mt. ♂ 1, birch-lichen mat by sweeping *B. nana*, sample I, 4. vii.

"A common species on all the Greenland coast. Occurs on almost all European mountains reaching above tree-limit, but is not known from North America."

Itoplectis alternans kolthoffi Auriv.

U., W. ♂ 1, top layer, 1. vii.

"Melanistic form of a common European species. This form occurs also in North Europe and in the smoky industrial part of West Germany, being one of the 'industry melanisms' discovered in later years."

Plectiscus hyperboreus Holmg.

U. ♂ 1, 13. vii. ♀ 1, 20. vii.

"The antennal flagellum of the present ♀ 19-jointed, of the ♂ 20-jointed. Not rare in Greenland nor in North Europe, but in Central Europe only found on the Baltic coast of Germany."

Plectiscus collaris Gr.

U., W. ♂ 1, top layer, 1. vii.

"The specimen has a 20-jointed flagellum. Rarer in Greenland than the last species, but common in North Europe, at least to the Alps."

**Aniseres lubricus* Foerst.

U. ♂ 1, on *Empetrum*, 17. vii.

"Known from Central Europe with England, in Sweden from the Stockholm region. The specimen is typical, with 20-jointed flagellum."

TRYPHONINÆ.

Banchus monileatus Gr.

U., W. On top layer, ♂ 2, 1. vii.; 1, 2. vii.
U. On *Salix*, ♂ 1, 13. vii.; ♀ 1, 15. vii.; ♀ 1, 16. vii.
U. On *Empetrum*, ♂ 1, ♀ 2, 17. vii.

"This is the commonest larger Ichneumonoid in Greenland, though rare in North and Central Europe."

Homotropus ornatus Gr.

L., W. ♂ 1, on *Salix*, 11. viii.

"Only one ♀ of this species has previously been known from Greenland (Lundbeck). In north and central Europe it is not common, and Morley reports it from the Punjab, N.W. India. The Stockholm Museum owns a conspicuously coloured form taken near the top of one of the Birunga mountains in central Africa."

Homotropus melanogaster Holmg.

U., W. Top layer, ♂ 1, ♀ 1, 1. vii.
U., W. Shrub layer, ♀ 1, 20. vii.

Homotropus elegans nigritarsus Gr.

U., Mt. ♀ 1, birch-lichen mat, sweep of *B. nana*, 4. vii.

"The Greenland form mostly has the lower side of the femora basally with a brown or black spot or line. This is reminiscent of *H. nigrolineatus* Strobl. from alpine localities in Styria, which seems from the description to be about the same form, only still more melanistic. If there is to be a name for it, *grœnlandicus* Holmg. is the oldest one."

OPHIONINÆ.

**Angitia* (*Inareolata*) *laticeps*, sp. n., Roman.

All from Camp Lloyd.
W. ♀ 1, among humus, 8. viii.
G. ♂♂ 2, on grass, 10. viii.
W. On *Salix*, ♀ 1, 11. viii.; ♂♂ 2, ♀♀ 2, 13. viii.; ♂♂ 3; ♀♀ 4, sweeping from *Salix*, 18. viii.
H. ♂ 1, on *B. nana*, 24. viii.

Dr. A. Roman has kindly sent me the following description:—"♂♀ *Angitia* (*Inareolata*) *exareolata* Ratz. magnitudine et structura simillima, at capite pone oculos ne minime quidem angustato, lateribus supra visis antice parallelis rectis, postice fortiter rotundata, diversa. Sweden, central Lapland, 1 ♀ (*Boheman*), type; Prov. Småland, 1 ♂ (*Boheman*), allotype. Siberia, Samarova, 1 ♀ (*J. Sahlberg*). Also the specimens above mentioned collected by H. G. Vevers.

"I have not been able to see any other difference from the rather well-known *exareolata* Ratz. than the form of the head, but that is conspicuous when once observed. The ♂ ædeagus may possibly furnish more characters, but until that is known this form would perhaps be better known as a northern race, replacing the more southern, typical one. The place Samarova is situated either at the river Ob or at the river Yenissei. The maps I have seen show only a place Samarovskojo at the big bend in the middle course of Ob, and that may be the same as Samarova in our old locality labels. The subgeneric name *Inareolata* Ell. & Sachll. is simply a substitute for *Diocles* Foerst., preoccupied in the Coleoptera."

CHALCIDOIDEA

Encyrtidæ.

**Microterys tessellatus* Dalm.

U., Mt. ♀ 1, birch-lichen mat, sweeping of *B. nana*, 28. vi.
U., C. ♀ 1, 2. vii.

Dr. Ch. Ferrière, who kindly identified the Chalcidoidea, wrote: "These two are varieties with shorter wings. They agree exactly with the descriptions of *tessellatus*, and I have compared them with specimens of that species in the British Museum (Nat. Hist.), from which they differ only by the shorter wings, which reach only slightly beyond the tip of the abdomen. The second interrupted hyaline band on the fore wings, which is at about two-thirds the length of the wing in normal specimens, is here near the end of the wing and narrower. But I consider these specimens as only a variety of *tessellatus*."

I have found no record of this species from Greenland.

Pteromalidæ.

**Habrocytus* sp.

L., W. ♂ 1, on *Salix*, 13. viii.

Dr. Ferrière was unable to do more than to determine the genus. I can find no previous record for it from Greenland.

CYNIPOIDEA.

Figitidæ.

**Anacharis eucharioides* Dalm.

U., W. ♂ 1, shrub layer, sweep 1, 20. vii.

L., W. On *Salix*, ♂♂ 3, ♀♀ 2, 11. viii; ♂♂ 5, ♀ 2, 13. viii.

Dr. H. Hedicke, who kindly identified the specimens, wrote: "They are *Anacharis eucharioides* Dalm., a Figitid widely distributed in the North of Europe, but not yet known from Greenland."

DIPTERA.

NEMATOCERA.

Dr. F. W. Edwards, who kindly identified the Nematocera, added the following general remarks:—"The extension of the known range of some of the species is interesting, and two, *Culicoides sordidellus* Zett. and *Gonempeda caudata* Lbk., had not previously been received at the British Museum. Unfortunately most of the Chironomidæ are represented by a few females only, and cannot be precisely determined. It is noteworthy that at most four of the twenty-three species represented were also found by Mr. D. Lack or Mr. F. S. Chapman in East Greenland in 1933 (Edwards, 1935, Ann. & Mag. Nat. Hist. (10) xv. pp. 467–473)." The arrangement of the families is, for the sake of uniformity, as in Imms's 'Textbook,' 1934.

Tipulidæ.

Tipula arctica Curt.

U., C. ♂ 1, on *B. nana*, 30. vi.

Ormosia fascipennis Zett. (*holtedahli* Alex.).

U., C. ♂ 1, 10. vii.; ♀ 1, 18. vii. Generally distributed, or flying over willow scrub.

Gonempeda caudata Lbk.

L., W. ♀♀ 2, willow scrub, on *Salix*, 11. viii.

Trichoceridæ.

(N.B.—This family is not recognized by Imms, who places *Trichocera* in Rhyphidæ at the end of the Nematocera.)

Trichocera ? *lutea* Becher.

U., C. ♀ 1, on *B. nana*, 30. vi.

Culicidæ.

Aëdes nigripes Zett.

U., C. ♀♀ 10, 8. vii. ; 3, 17. vii.

Chironomidæ.

Metriocnemus (s. str.), sp. indet.

U., W. ♀ 1, 1. vii.

Metriocnemus (*Paraphænocladius*) *graminicola* Lbk. (?).

U. ♀ 1, prey of spider, 13. vii.

Cricotopus vitripennis Mg. (*variabilis* Staeg.).

U., W. ♀ 1, swept from top layer, 1. vii.
U., W. ♂ 1 ; shrub layer, ♀ 1, 2. vii.
U., W. ♀ 1, flying over willow scrub, 10. vii.
U., W. ♀ 1, prey of spider, 13. vii.
U., C. ♀ 1, sweep of *B. nana*, 19. vii.

Spaniotoma (*Orthocladius*) sp., cf. *rubicunda* Mg.

U., W. ♀ 1, flying over willow scrub, 10. vii.
U., W. ♀ 1, sweep of shrub layer, 11. vii.
U., W. ♂ 1, on *Salix*, 17. vii.

Spaniotoma (*Orthocladius*) sp., cf. *vernalis* Goet.

L., H. ♀ 1, on *B. nana*, 24. vii.

Spaniotoma (*Orthocladius*), sp. indet.

U., W. ♀ 1, prey of spider, 13. vii.

Spaniotoma (*Limnophyes*) *borealis* Goet.

U., W. ♂ 1, sweep of shrub layer, 13. vii.
U., W. ♂ 5, field layer, in swarms below the level of *Salix*, 15. vii.
U., W. ♂ 1, on *Salix*, 17. vii.

Dr. Edwards comments on this species :—" Goetzghebuer does not mention the rather numerous scales, which are present in the prescutellar area and shoulders in these specimens ; the A.R. is also slightly less than stated by him (1·0 instead of 1·2), but the hypopygium is similar."

Spaniotoma (*Limnophyes*) sp. cf., *minima* Mg.

U., W. ♂ 2, swept from top layer, 1. vii.
U., W. ♂ 1, flying over willow scrub, 10. vii.
U., W. ♂ 1, field layer, 11. vii.
U., W. ♂ 2, sweep of shrub layer, 13. vii.

Dr. Edwards comments: "A rather smaller species than the last, without obvious scales on them, A.R. about 0·7." I have not found a record for *minima* from Greenland.

Spaniotoma (*Smittia*), sp. indet.

U., Mr. ♀ 1, prey of spider, 29. vi.
U., C. ♀ 1, swept from *B. nana*, 19. vii.

Spaniotoma (*Smittia*), sp. indet.

U., W. ♀ 1, swept from top layer, 1. vii.
U., C. ♀ 1, 10. vii.

Ceratopogonidæ.

Culicoides sordidellus Zett.

L., G. ♀♀ 10, biting in swarms after rain, 9. vii.

Dr. F. W. Edwards writes as follows :—" As this species is very little known, I give some additional data to facilitate identification ; it is one of the largest species of the genus, with wing about 2·3 × 1 mm. Eyes narrowly but distinctly separated (by about the width of one facet). Mesonotum grey, without conspicuous markings, but with a pair of somewhat darker patches posteriorly. Spermathecæ two, subglobular (I cannot detect the third rudimentary spermatheca in the specimen mounted). Legs dark, tibiæ not ringed. Wing with macrotichiæ dense on distal half, sparser on basal half. Costa strongly thickened above radial cells, first radial cell very narrow, second rather broader, but about equal in length to first. Markings diffuse and rather indistinct ; about half of second radial cell included in the pale area ; only two small indistinct pale marks in median fork ; cubital fork dark at base, with a pale spot on margin of wing. The species is not included in the recent review of the North American species of *Culicoides* by Root and Hoffman (Amer. J. Hyg. xxv. pp. 150–176, 1937), though their new species *C. gigas* seems to be similar in most respects."

Mycetophilidae.

Boletina grœnlandica Staeg.

U., W. ♀ 1, flying over willow scrub, 10. vii.

U., W. ♀ 1, field layer, swarms below level of *Salix*, 15. vii.

U., W. ♀ 1, on *Salix*, 17. vii.

Boletina sp., cf. *sciarina* Mg.

U., W. ♀ 1, sweep of shrub layer, 11. vii.
U., W. ♀ 2, shrub layer, 14. vii.
U., W. ♀ 1, field layer, swarms below level of *Salix*, 15. vii.
U., W. ♀ 2, on *Salix*, 17. vii.

**Sciara consimilis* (Holmgr.) Edw.

U., C. ♂ 1, sweep of *B. nana*, 18. vii.

Dr. Edwards writes: "Agrees well with specimens I have examined from Bear Island and Spitsbergen." I have been unable to find this species in previous records of Greenland fauna, though it may possibly have been recorded under another name.

Sciara, spp. indet.

U., C. ♀ 1. prey of spider, 30. vi.
U., W. ♀ 1, field layer, 11. vii.
U., W. ♀ 1, sweep of shrub layer, 13. vii.
U., C. ♀♀ 2, generally distributed, 17. vii.
L., W. ♀ 1, among humus, 8. viii.
L., W. ♀ 1, on *Salix*, 13. viii.

**Sciara* (*Scatopsciara*) *vivida* Winn.

U., C. ♂ 1, 16. vii.

Dr. Edwards writes: "This common European species has been recorded from Iceland, but not from other parts of the Arctic unless (as is probable) one or more of Holmgren's or Lundbeck's names may apply to it."

Simuliidae.

Simuliium vittatum Zett.

U., C. ♀♀ 4, 8. vii.
U., W. ♀♀ 4, flying over willow scrub, 10. vii.
U., W. ♀♀ 3, shrub layer, 14. vii.
U., W. ♀♀ 3, on *Salix*, 17. vii.

Simulium arcticum Mall.

L., G. ♀♀ 10, in swarms, biting, 9. viii.

BRACHYCERA.

Empididæ.

Rhamphomyia nigrita Zett.

U., C. ♂ 1, ♀ 1, 30. vi.
U., W. ♂♂ 3, ♀ 1, flying over willow scrub, 10. vii.
U., W. ♂♂ 3, ♀ 1, on *Salix* and flying high, 16. vii.
U., W. ♂♂ 2, ♀ 1, on *Salix*, 17. vii.

Dolichopodidæ.

Dolichopus grœnlandicus Zett.

U., W. ♂ 1, shrub layer, 2. vii.
U., W. ♀ 1, field layer, 14. vii.
U., C. ♀ 1, sweep of *B. nana*, 19. vii.
U., W. ♀ 1, shrub layer, 20. vii.
U., C. ♀ 1, 21. vii.

CYCHORRHAPHA.

ASCHIZA.

Phoridæ.

Aphiochæta grœlandica Ldbk.

U., Mt. ♂ 1, birch-lichen mat, sweep of *B. nana*, 28. vi.; ♂ 1, 2. vii.
U., W. ♂ 1, sweep of shrub layer, 13. vii.
U., W. ♂ 1, field layer, 14. vii.

Syrphidæ.

Platychirus hyperboreus Staeg.

U., Mt. ♂♂ 4, birch-lichen mat, 27. vi.
U., Mr. ♂♂ 2, ♀ 1, on *B. nana* and *Salix*, 29. vi.
U., C. ♂ 1, ♀♀ 4, on *B. nana*, 30. vi.
U., W. ♂ 1, ♀ 1, swept from top layer, 1. vii.
U., W. ♂♂ 3, ♀♀ 2, shrub layer, 2. vii.
U., W. ♂ 1, flying over willow scrub, 10. vii.
U., Mr. ♀♀ 4, hovering over *B. nana*, 10. vii.
U., W. ♀ 1, shrub layer, 14. vii.

U., W. ♀ 1, on *Salix*, 14. vii.
U., Mr. ♀ 1, hovering over *B. nana*, 15. vii.
U., C. ♀ 1, sweep of *B. nana*, 19. vii.
U., C. On *Elymus*, ♀ 1, 19. vii.
U., C. ♀ 1, visiting *Salix* and *Campanula*, 20. vii.
U., C. ♀ 1, visiting *Ledum*, 20. vii.

Melanostoma lundbecki Coll.

U., Mt. ♂ 1, on *Salix*, 28. vi.
U., Mt. ♀ 1, hovering over *B. nana*, 10. vii.

Syrphus tarsatus Zett. var.

U., W. ♂ 1, on *Salix*, 15. vii.
U., Mt. ♀ 1, birch-lichen mat, 27. vi.

Mr. J. E. Collin, who kindly identified the Brachycera, wrote:—"The question of the number of species in the Arctic regions of the *S. luniger* and *S. tarsatus* groups will never be cleared up until someone is sent there who knows something of the problem and how to collect specimens in good condition.

"Among the six males of the *S. tarsatus* group in your material there are indications of four species, and if I could obtain specimens of true *tarsatus* to dissect I could at least prove whether any of them are entitled to be called by that name."

Syrphus ? tarsatus.

U., W. ♂ 1, on *Ledum* and *Salix*, 16. vii.
U., C. ♀ 1, on *B. nana*, 30. vi.
U., W. ♀ 1, visiting *Ledum*.
L., G. ♀ 1, on *B. nana* and *Salix*, 18. viii.

Syrphus, sp. of *tarsatus* group.

U., Mr. ♀ 1, on *B. nana* and *Salix*, 29. vi.
U., C. ♀♀ 4, on *B. nana*, 30. vi.
U., W. ♀♀ 2, swept from top layer, 1. vii.
U., Mr. ♀♀ 2, hovering over *B. nana*, 10. vii.
U., W. ♀ 1, on *Salix*, 15. vii.
U., Mr. ♀ 1, over moss bog foot, 21. vii.

Syrphus arcuatus Fln.

L., G. ♀ 1, on *B. nana* and *Salix*, 18. viii.

Syrphus arcuatus group, near *neoperplexus* Curr.

U., C. ♀ 1, on grass, 8. vii.
U., W. ♀ 1, hovering over *Salix*, 13. vii.
L., W. ♂♂ 2, visiting *Salix* flowers, 11. viii.

Syrphus torvus O. S.

U., W. ♀ 1, swept from top layer, 1. vii.

Sphærophoria strigata Staeg.

U., Mt. ♀ 1, birch-lichen mat, on *Dryas integrifolia*, 25. vi.
U., Mt. ♂ 1, birch-lichen mat, on *Salix*, 28. vi.

SCHIZOPHORA.

Agromyzidæ.

**Liriomyza* sp. near *perpusilla* Mg.

L., H. ♂♂ 2, ♀ 1, on *B. nana*, 24. viii.

Mr. J. E. Collin informs me that he does not think the genus *Liriomyza* has previously been recorded from Greenland. I have found no record.

**Phytomyza* ? *nigra* Mg.

L. H. ♀♀ 3, on *B. nana*, 24. viii.

Ph. nigra does not appear to have been recorded from Greenland.

Cordyluridæ.

Microprosopa hæmorrhoidalis Mg.

L., G. Pair *in copula*, 18. viii.

Scatophaga furcata Say (*squalida* Mg., *varipes* Holmg.).

U., C. ♂♂ 2, ♀♀ 3, on dung, 16. vii.
U., C. ♀ 1, on dung, 18. vii.
L., G. ♂♂ 5, ♀♀ 2, on dung; includes two pairs *in copula*, 10. viii.
L., W. ♂ 1, by sweeping, 11. viii.
L., G. ♂♂ 8, ♀ 1, 24. viii.

Scatophaga nigripes Holmgr.

Males, all collected by D. M. Stevens, Utorkait, on shore, drift-line seaweed, 2, 10. vii.; 1, 12. vii.; 1, 13. vii.; 1, 14. vii.; 1, 15. vii.

Piophilidæ.

Piophila pilosa Staeg.

U., C. ♂ 1, generally distributed, 17. vii.
U., W. ♀ 1, swept from top layer, 1. vii.
U., C. ♀ 1, 3. vii. ; 1, 10. vii. ; 1, 17. vii.

Piophila vulgaris Fln.

U., C. ♂ 1, ♀♀ 3, generally distributed, 17. vii.
U., C. ♂ 1, ♀♀ 2, generally distributed, 18. vii.

CALYPTERA.

Anthomyidæ.

**Graphomyia picta* Zett.

U., C. ♀ 1, on dung, 18. vii.

**Phaonia pallidisquama* Zett.

U., Mt. ♀ 1, prey of spider, 27. vi.

Limnophora (*Spilogona*) *arctica* Zett.

U., W. ♂♂ 2, swept from top layer, 1. vii.
U., W. ♂♂ 3, ♀ 1, shrub layer, 2. vii.
U., W. ♀♀ 4, flying over willow scrub, 10. vii.
U. ♂ 1, on shore, drift-line seaweed, D.M.S., 12. vii.
U., W. ♀ 1, on *Salix*, 13. vii.
U., W. ♂ 1, on *Salix*, 14. vii.
U., W. ♀ 1, on *Salix*, 16. vii.
U., W. ♂ 1, ♀ 1, on *Salix*, 17. vii.
U., W. ♂ 1, ♀ 1, shrub layer, sweep I, 20. vii.
U., C. ♀♀ 2, 21. vii.
L., W. ♀♀ 4, on *Salix*, 11. viii. ; 1, 13. viii. ; 2, 18. viii.

Limnophora (*Spilogona*) sp.

U., C. ♀ 1, on *B. nana*, 30. vi.

**Fannia bifimbriata*, sp. n., Collin.

U., W. ♂ 1, ♀ 1, swept from top layer, 1. vii.
U., W. ♂ 1, shrub layer, 2. vii.
U. ♀ 1, on shore, drift-line seaweed, D.M.S., 12. vii.
U., C. ♀ 1, on human dung, 16. vii.

The description of the species, based on the above co-types, is given by Mr. J. E. Collin, as follows :—" Allied to *F. monilis* Hal. and *ciliata* Stein, the male having the dense fringe at tip of front tibia of the former and the remarkably fringed hind tibia of the latter. Except for having front legs resembling those of *monilis* Hal., the male is almost indistinguishable from a specimen of *ciliata* Stein. The female differs from *monilis* (I do not know *ciliata* ♀) in the chætotaxy of hind tibiæ. In *monilis* there are only four or five antero-ventral bristles, and a row of small antero-dorsal bristles ending in a stronger one at about one-third from tip. In *bifimbriata* there are seven or eight antero-ventrals (as given by Stein in 1914 for *ciliata* ♀), and the strong antero-dorsal bristle is placed out of alignment with the row of smaller bristles (more dorsal), and quite *close to* (slightly below) *the long dorsal bristle* at middle of tibia. Length about 4·5–5·5 mm. (one ♀ only 3·5 mm.)."

Hydrotæa bispinosa Zett.

U., W. ♂ 1, visiting *Ledum*, 16. vii.

Pegomyia tenera Zett. var. *obscurior* Coll.

U., C. ♂♂ 2, on *B. nana*, 30. vi.
U., W. ♂♂ 5, ♀ 1, swept from top layer, 1. vii.
U., W. ♂♂ 3, ♀♀ 3, shrub layer, 2. vii.
U., Mt. ♂ 1, birch-lichen mat, 3. vii.
U., Mr. 10. vii, ♂ 1, sweep II ; ♂ 1, flying over willow scrub ; ♂ 1, hovering over *B. nana*.
U., W. On *Salix*, ♂♂ 2, ♀♀ 3, 14. vii. ; ♂ 1, 15. vii. ; ♂♂ 2, ♀ 1, 16. vii. ; ♂♂ 2, ♀♀ 3, 17. vii.
U., W. 20. vii, ♂ 1, ♀ 1, sweep, shrub layer ; ♂ 1, visiting *Cerastium*.
U., C. ♀ 1, 10. vii. ; ♀♀ 3, 21. vii.

Pegomyia sp. ?

U., W. ♂ 1, on *Salix*, 14. vii.

Pegohylemyia profuga Stein.

U., W. ♂♂ 2, shrub layer, 2. vii.
U., W. ♂ 1, flying over willow scrub, 10. vii.
U., W. ♀♀ 2, shrub layer, 14. vii.
U., W. ♂♂ 3, on *Salix*, 17. vii.
U., C. ♂ 1, sweep of *B. nana*, 19. vii.
U., C. ♀♀ 3, 21. vii.

Paregle radicum L.

U., C. ♀♀ 5, on dung, 16. vii.
L., G. ♀♀ 2, on dung, 10. viii.
L., G. ♀♀ 3, 24. viii.

Delia octoguttata Zett.

U., Mt. ♂ 1, birch-lichen mat, 27. vi.
U., Mt. ♀ 1, birch-lichen mat, 3. vii.
L., G. ♀ 1, 24. viii.

Delia sp. (? *fabricii* Holmg.).

U., C. ♀ 1, sweep of *B. nana*, 19. vii.
L., G. ♀ 1, on dung, 10. viii.
L., H. ♀♀ 3, on *B. nana*, 24. viii.

Fucellia intermedia Ludbk.

U. On shore, drift-line seaweed, D.M.S., ♂♂ 3, 10. vii.; ♂ 1, ♀ 1, 12. vii.; ♀ 1, 13. vii.; ♂ 1, ♀♀ 2, 14. vii.
U. C. ♀ 1, on dung, 14. vii.
U., C. ♂♂ 2, on dung, 16. vii.

Fucellia fucorum Fln.

U. ♂♂ 2, on shore, drift-line seaweed, D.M.S., 10. vii.

Tachinidæ.

Tenuirostra arctica Sack.

U., Mt. ♂ 1, birch-lichen mat, 2. vii.

Phormia grœnlandica Zett.

U. ♂ 1, on shore, drift-line seaweed, D.M.S., 15. vii.

Phormia atriceps Zett.

U., Mt. ♀♀ 2, birch-lichen mat, 27. vi.
U. On shore, drift-line seaweed, D.M.S., ♀♀; 2, 10. vii.; 1, 13. vii.; 1, 14. vii.; 3, 15. vii.

Calliphora uralensis Vill.

U., C. ♀ 1, on dung or food, 2. vii; ♀ 1, 10. vii.
U. ♀ 1, on shore, drift-line seaweed, D.M.S., 12. vii.; ♀ 1, 14. vii.; ♂ 1, 15. vii.
U., C. ♀♀ 3, on food, 14. vii.

U., C. ♂♂ 5, ♀ 1, on dung or food, 16. vii., ♀ 1, 18. vii.
L., W. ♀ 1, on *Salix*, 11. viii.
L., G. ♂ 1, ♀ 1, 24. viii.

APHANIPTERA.

Ceratophyllidæ.

**Ceratophyllus borealis* Rthsch.

Utorkait, from Snow-Bunting.

Apparently not previously recorded from Greenland. Rothschild (1915, Ent. Mon. Mag. li. p. 71) says: "A rare species, apparently confined to Great Britain, and so far only recorded from Scotland from the nests of the Rock-Pipit (*Anthus obscurus*), the Gannet (*Sula barrana*), and some other birds." I have not found any mention of it in lists of Greenland fauna, and Dr. Jordan kindly informs me that he knows of no record of *C. borealis* from Greenland.

LXII.—*A Note on some Rhizopoda of the Genus* Nebela *from Westmorland.* By G. H. WAILES.

IN gatherings of sphagnum and algæ made in the Kentmere Valley, near Ambleside, in September 1937, the following species of *Nebela* occurred, most of them numerously :—

Nebela collaris (Ehrenb.).
—— *dentistoma* Penard.
f. *lageniformis* Playfair.
—— *flabellulum* Leidy.
—— *militaris* Penard.
—— *minor* Penard.
Nebela parvula Cash.
—— *tincta* (Leidy).
—— *symmetrica* (Wallich).
var. *longicollis*.
—— *penardiana* Deflandre.
—— *wailesi* Deflandre.

These species are more or less common and generally distributed in Great Britain, but the three last names have only recently been given by Deflandre ('Annales de Protisiologie,' vol. v. 1936), and not having been included previously in published records of British species the following short explanatory notes are appended.

Nebela symmetrica.—This species has hitherto been known as *Quadrulella* (*Quadrula*) *symmetrica*, but is now quite rightly transferred to the genus *Nebela*, taking its place in the group having tests similarly composed of quadangular plates ; this group consists of the species

N. tropica Wailes, *N. quadriga* Deflandre, and *N. scutella* Wailes, none of which, however, have been recorded from Great Britain.

Nebela penardiana may have hitherto been attributed to either *N. longicollis* Penard or *N. americana* Taranek, but it differs from both ; Taranek describes his species as circular in section, a characteristic which has never since been recorded in a test of this type, and the species must be regarded as a doubtful one.

Fig. 1.

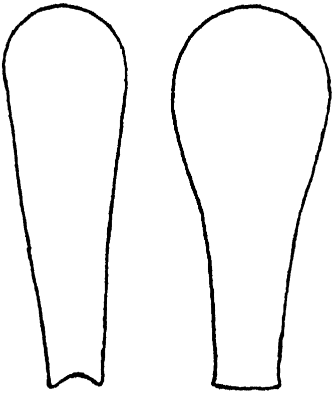

Fig. 2.

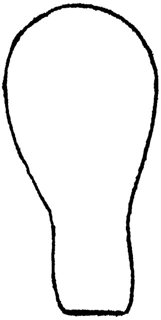

Fig. 1.—*Nebela penardiana* Deflandre (1936). Small form. ×480.
Fig. 2.—*Nebela wailesi* Deflandre (1936). ×480.

Most of the individuals of *Nebela penardiana* found here measured in length 125 to 164 μ (140 to 175 μ, Deflandre),

but a *small form* also occurred having the following dimensions :—

Length 100 to 110 μ, breadth 42 to 50 μ, thickness 34 to 40 μ, aperture 18 × 12 to 22 × 14 μ. (Fig. 1.)

Nebela wailesi (fig. 2) has hitherto been recorded a *N. lageniformis* var. *minor* Wailes; it is generally distributed in Great Britain and measures 75 to 100 μ in length.

I have to thank Miss P. M. Jenkin, Bristol University, for kindly collecting the material whilst in residence at the Freshwater Biological Association's Laboratory in the Lake District.

LXIII.—*Drei neue malayische Limacodiden* (*Lep.*).

Von MARTIN HERING (Berlin).

DER Liebenswürdigkeit von Sir Guy A. K. Marshall, Director of the Imperial Institute of Entomology, verdanke ich die Bekanntschaft mit 3 neuen Arten von Limacodiden, von denen die eine besonders durch ihre geringe Grösse auffällt und die kleinste orientalische Limacodide, die bisher bekannt wurde, darstellt. Die Typen sämtlicher Arten befinden sich im British Museum, London.

1. *Parasa vinculum*, spec. nov.

Die neue Art steht am nächsten *P. lorquini* Reak., 1864, lässt sich von dieser aber sogleich dadurch unterscheiden, dass der grüne Subbasalfleck der Vorderflügel nahezu dreieckig ist und nach vorn hin höchstens spurweise den Zellhinterrand überschreitet. Oberseite der Vorderflügel und des Körpers einfarbig dunkel chocoladebraun, Hinterflügel an der Wurzel beim ♂ ganz schmal bleich ockergelb, beim ♀ etwas ausgedehnter, etwa bis zum Zellende reichend. Im Vorderflügel ein subbasaler apfelgrüner Fleck wie bei der verglichenen Art, der aber ein gerundetes Dreieck darstellt, dessen eine spitze Seite der Flügelwurzel zugewendet ist. Die grösste Seitenlänge dieses Dreiecks beträgt 2·5 (♂)–4 (♀) mm. Unterseite einfarbig chocoladenbraun, beim ♂ die Zelle der Vorderflügel grünlichgelb gefüllt, im Hinterflügel diese

Bestäubung nur ± angedeutet. Das ♀ unten ähnlich, die Hinterflügelzel le deutlicher gelb bestäubt. Vorderschienen am Ende mit einem Silberfleck. Vorderflügellänge 13 (♂)–18 (♀) mm.

♂, ♀ Type von Makasser, Celebes, viii. 1937, von Cocos-Blättern erzogen.

2. *Trichogyia dilutata*, spec. nov.

Die nächstverwandte Art ist *T. semifascia* Hampson, 1894 ; von dieser ist die neue Art sogleich durch geringere Grösse und die undeutliche Ausprägung der auf der Mitte des Innenrandes stehenden weissen Linie zu unterscheiden. Körper und Flügel braungrau, mit etwas rotbrauner Tönung, die bei der verglichenen Art fehlt. Hinterflügel reiner grau. Auf der Mitte des Innenrandes eine wenig deutliche, weissliche Linie, die aber proximal (bei der verglichenen Art distal) dunkel gerandet ist. Diese Linie verläuft nicht grade, sondern geht etwas gewellt, reicht auch weiter nach vorn, etwa der Querader folgend, bis ans obere Ende der Zelle. Die Wellenlinie ist nicht wie bei der ähnlichen Art scharf, sondern fast vollständig fehlend, nur in Andeutung eines dunklen Schattens wurzelwärts von ihr wahrnehmbar. Unterseite einfarbig hellgrau. Palpen unten und aussen auffällig dunkel chocoladebraun. Vorderflügellänge 6–7 mm.

♂, ♀ Type von Tegal, Java, leg. R. Awibowo, von Cocos-Blättern gezüchtet, i. & iv. 1933.

3. Venorbator, gen. nov.

Von allen anderen indoaustralischen Genera unterscheidet sich diese neue Gattung durch das (anscheinende) Fehlen der Ader 11 und das weit proximal verlagerte Entspringen des Stieles von Ader 8–10. Im Vorderflügel entspringt Ader 2 vor der hinteren Zellecke, 3+4 von dieser, fast stets gestielt, sehr selten getrennt, 5–7 in etwa gleichen Abständen, 7 aus der oberen Zellecke, 8–10 gestielt, 10 vor 8+9 entspringend (selten fehlend). Ader 11 fehlt. (In Wirklichkeit wird 8+9 verschmolzen sein !) Der Stiel von 8–10 entspringt etwa gegenüber dem Ursprung von Ader 2. Im Hinterflügel ist die Stellung der Adern ähnlich, also auch 3+4 gestielt, 6 und 7 weit getrennt, Ader 8 ist mit dem Vorderrand der Zelle hinter dessen Mitte durch einen Steg verbunden. Hinterschienen mit 2 Paar von langen Spornen, die äusseren an den Endspornen 1/3, an den inneren 2/3 der inneren lang. Palpen kurz, vorgestreckt, 1½mal so lang wie der Augendurchmesser. Fühler bei beiden Geschlechtern einfach, kürzer als der Vorderflügel.

Generotypus : *Venorbator minimus*, spec. nov

Venorbator minimus, spec. nov.

Thorax und Vorderflügel bräunlich. Bei den letzteren geht eine weisse Schräglinie, die sehr schmal und grade verläuft, von 2/3 des Vorderrandes nach Ader 3, ohne deren Mündung zu erreichen, da sie vorher stumpfwinklig umknickt und ein sehr kurzes Stückchen dem Saum parallel geht. Kurz vor dem Saum verläuft, diesem parallel, eine dunkelgraue Linie, die ziemlich undeutlich ist, sich aber auf Ader 3 und 4 in je einen kleineren und auf Ader 2 in einen grösseren tiefschwarzen Punkt verdickt. Weiter finden sich undeutliche schwarze Schuppen in den basalen 2/3 des Flügels, zu schwarzen Flecken gehäuft an der Querader und unter der Mitte der Zelle. Fransen am Ende tief schwärzlich. Hinterflügel schwarzgrau, mit haarartigen schmalen Schuppen besetzt ; im Analfeld hell ockergelbe mit tiefschwarzen, breiten Schuppen gemischt, dieses Feld dadurch grobschuppig tiefer schwarz erscheinend. Hinterleib wie die Hinterflügel gefärbt. Unterseite der Vorderflügel hell rotbraun, die weisse Linie ± angedeutet. Die Vorderflügel der Männchen sind schlecht erhalten, sie scheinen aber undeutlicher gezeichnet zu sein. Vorderflügellänge 4(♂)–6 (♀) mm. Auch diese Art wurde von Cocos-Blättern erzogen.

♀ Holotype von Poerbolinggo, Java, 27. ix. 1935, leg. R. Awibowo ; ♂ Allotype von Keboemen, Java, 12. vii. 1934, ausserdem eine Anzahl von Paratypen.

LXIV.—*Some Snakes of the Genus* Tropidophis. By J. C. BATTERSBY, Department of Zoology, British Museum (Natural History).

IN the course of relabelling and checking the determinations of the West Indian specimens of *Tropidophis* in the collection of the British Museum two examples of an apparently undescribed race from Grand Cayman were

discovered. Some of the other specimens have been mentioned by recent reviewers as being of somewhat uncertain status, and these have been critically re-examined in the light of modern views on the taxonomy of the genus. The following notes on these individuals, in the compilation of which I have been aided by Mr. H. W. Parker, are offered in the hope that they may be of assistance to future workers on these exceedingly variable snakes.

Tropidophis melanurus caymanensis, subsp. n.

Holotype a female, number 1912.7.18.1, from Grand Cayman Island, collected by Mr. T. M. Savage English.

Head distinct from neck; snout inclined to be spatulate. Rostral broader than high, just visible from above. The anterior pair of prefrontals much larger than the posterior and larger than the internasals, reaching the upper labials. Frontal about 1⅔ times as long as broad, shorter than its distance from the rostral, broader than the supraoculars. 1 pre- and 3 postoculars; temporals 3+4 and 2+4; 10 upper labials, the fourth and fifth entering the eye; 13 lower labials, first two in contact with the anterior pair of chin-shields. A pair of small parietals completely separated by two small scales. Maxillary teeth 15, mandibular 17, pterygoid 10; palatine 6.

Scales on the body in 23 : 25 : 17 rows, all except the four or five outer rows with broad, weak keels. Ventrals 191; caudals 36. Total length 448 mm.; tail 50 mm.

The ground-colour is pale brown. A lighter vertebral zone with darker, irregular spots flecked with black extends along the whole of the body and tail. The spots are about sixty-five in number, joined together by a band of the same colour and covering about eight scales. A darker longitudinal band, varying from one to three scales in width, on either side of the vertebral zone becomes less marked posteriorly and disappears before reaching the tail. Another, much less distinct, dark line lies about three or four scale-rows below this. A series of smaller ill-defined dark spots lies between the two lateral lines. The ventral surface is cream, speckled with dark brown, and this colour extends on to the third and fourth lateral scale-rows. An irregular, indistinct series of large spots on either side of the ventrals becomes more noticeable posteriorly. End of tail white, immaculate beneath. Head brown-dusted with two dark transverse lines across the interorbit. A dark streak edged with black beneath runs from the corner of the mouth to the posterior corner of the eye, and is continued on to the snout, becoming much less distinct anteriorly. Upper and lower labials yellow, heavily speckled with brown.

The paratype, number 1912.7.18.2, a female with the same data as the type, has a similar colour-pattern, but differs from the holotype in having anomalous head-scales. The prefrontal is broken up into three, an anterior pair and a large median one behind. A small scale is interposed between the internasals and the anterior pair of prefrontals. Two other small scales reach from the posterior edges of the anterior pair of prefrontals to the frontal, completely separating the posterior pair of prefrontals. The anterior prefrontals are much narrower and do not reach the upper labials, there being a loreal between the preoculars and the posterior nasal. The upper labials are excluded from the eye by a scale intercalated between, and uniting, the pre- and postoculars.

The scale counts are 23 : 25 : 17 ; ventrals 200 ; caudals 36. Total length 430 mm. ; tail 45 mm.

This subspecies appears to be closely allied to *melanurus*, but differs in having the frontal distinctly shorter than its distance from the end of the snout, a lower number of scale-rows, 23 : 25 : 17 (vice 25/27 : 27/29 : 19), fewer pterygoid teeth, and feebly keeled scales.

Miss Stull, in her revision of the genus (Occ. Pap. Mus. Zool., Michigan, no. 195, 1928), on pages 9, 10, and 17 refers to a specimen in the British Museum, said to have come from Cuba, which agrees better with the subspecies *Tropidophis maculatus haetianus* than with the typical Cuban form (*T. m. maculatus*). This specimen (B.M. reg. no. 1858.6.1.16) is a male, and certainly appears to agree more with *haetianus* not only in the scalation but also in its colour. The ventral spots often overlap and continue on to the anterior fourth of the body up to the head. The scale and dentition counts are as follows :—body-scales 25 : 27 : 17 ; ventrals 184 ; caudals 37. Maxillary teeth 15; mandibular teeth 19; pterygoid 13 and palatine 7. The vertebral dark markings cover about six scales, the lateral ones two to four sclaes. The ventral spots are large and rectangular, often intruding upon the first one or two scale-rows. This specimen was purchased from Parzudaki in 1858 with a mixed collection from various localities, and it is very probable that the locality " Cuba " is incorrect.

On page 17 in the same publication the author mentions another specimen in the British Museum, said to be from San Domingo, which has twenty-five scale-rows instead of twenty-seven to twenty-nine, as is usual in the subspecies from this island. The colour-pattern resembles that of *haetianus*; the vertebral dark spots cover about six to eight scales and the laterals from two to four scales; the ventral blotches are rectangular, but except on the tail do not overlap, although the space between them in some places is only about 1 mm.; the ventral spots are continued forwards on to the anterior fourth of the body, but become very small. It seems probable that, in this instance, the locality is correct, and the diagnosis of the subspecies *haetianus* must accordingly be emended, the number of scale-rows ranging from twenty-five to twenty-nine.

BIBLIOGRAPHICAL NOTICE.

Hydroids of the Pacific Coast of Canada and the United States. By FRASER C. MCLEAN. Toronto, 1937. The University of Toronto Press. Humphrey Milford. 11*s.* 6*d.* net.

THE systematist will always welcome any good work that collates the results of individual studies published in a number of different journals. Professor Fraser, himself an expert on the Hydroida, has brought together in convenient form the data available up to the present for the study of the Hydroid fauna of the Pacific Coast of Canada and the United States. The volume contains a description and drawings of almost every species known to occur there, as well as a number of new distributional records provided by a study of material collected by the 'Albatross' and 'Catalyst,' and from other sources.

A. K. T.

THE
ANNALS AND
OF
NATURAL HISTORY.

[ELEVENTH SERIES.]

No. 6. JUNE 1938.

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LXV.—*The Genus* Arbela *Stål* (*Hemiptera*, Nabidæ).

By H. M. HARRIS, Ames, Iowa.

BECAUSE of the paucity of details in the earlier specific characterizations individuals belonging to certain nabid genera always have been very difficult to identify. The receipt of a collection of unworked material belonging to the British Museum of Natural History, and kindly sent for study through the courtesy of Mr. W. E. China, makes it possible to present notes on some of these difficult groups. This paper is concerned with the genus *Arbela* Stål, and redefines its limits, reviews its history, catalogues the species, and gives a diagnostic key for their separation with new characterizations of the lesser known forms.

I am much indebted to the authorities of the British Museum of Natural History, the Deutsches Entomologisches Institut, the Zoologische Staatsinstitut und Zoologische Museum, and the U.S. National Museum for the loan of various nabid specimens.

In his great work 'Die Europaischen Hemiptera' F. X. Fieber characterized the genus *Acanthobrachys*, stating in a footnote that it was exotic. Since he failed to describe or mention a representative species, however, the name is invalid. Four years later Carolus Stål described a new species, *elegantula*, from the Island of Reunion (Bourbon), erecting for it the genus *Arbela*.

At the same time he referred to the new genus his *Nabis nitidula*, which had been described from Manila, Philippine Islands, in 1859. In 1870 a third species, *A. polita* Stål, from the Philippines, was added, and in 1873 a fourth, *A. costalis* Stål, from Fiji. The more salient characters of *Arbela*, as recognized by Stål, are the slender body, strongly approximate ocelli, long rostrum and antennæ, open front coxal cavities, and slender legs with the anterior femora and tibiæ beset with long rigid setæ.

The genus *Lorichius* Distant was established in 1904 for a new species (*umbonatus*) from Ceylon and Tenasserim. Its discriminative characters are essentially the same as those of *Arbela*, except that the posterior tibiæ of the male of *L. umbonatus* are globosely clavate near the base, a condition described by Fieber for his *Acanthobrachys*. Breddin, in 1905, recorded *Arbela nitidula* (Stål) from Java, and noted that in the male of this and all other species known to him the hind tibiæ are globosely swollen. On this basis Breddin suppressed *Lorichius* Distant and *Arbela* Stål as synonyms of *Acanthobrachys* Fieber. He also noted that Stål had only female examples of *A. nitidula*, *A. polita*, and *A. elegantula*, and in his assumption that all species possess swollen tibiæ suggested that Stål had overlooked this character in *A. costalis* or that, perhaps, the legs of the male specimens were mutilated.

In 1908 Reuter reviewed the history of the genus and followed Breddin in assuming that the males of all species had swollen hind tibiæ. He noted that *Acanthobrachys* Fieber was preoccupied by *Acanthobrachys* Jekel (1857, Coleoptera), and called attention to the similarity of the armature of the legs in *Arbela* Stål and certain species of *Nabis*, subgenus *Lasiomerus*, from tropical America. At this time Reuter suppressed his subgenus *Acanthonabis*, the principal character of which was the presence of long seta-like spines on the anterior and intermediate femora, as synonymous with *Lasiomerus*, and emphasized the subcontiguous ocelli of *Arbela* as a distinctive generic character. During the same year Kirkaldy described, from a female individual, a new species, *Acanthobrachys virescens*, from Australia.

In 1910 Distant, misinterpreting Reuter's reason for discarding Fieber's genus, resurrected *Acanthobrachys*.

The following year Bergroth pointed out Distant's oversight, and again suppressed *Acanthobrachys* in favour of *Arbela*.

Poppius, in 1915, erected the genus *Arbelopsis* for a new species, *simplicipes*, from Formosa, placing it near *Arbela*, from which he differentiated it by the less shiny body, the non-contiguous ocelli, presence of distinct veins in the membrane, and absence of basal thickenings on the hind tibiæ of the male. It is evident now, with our more recent knowledge of the earlier described species and with the discovery of the new forms characteized below, that these characters are variable within the genus *Arbela* Stål and that it is impossible clearly to differentiate between *Arbela* and *Arbelopsis*.

Genus ARBELA Stal.

1860. *Acanthobrachys* Fieber, Europ. Hemip p. 43 (invalid).
1865. *Arbela* Stål, Hemip. Afr. iii. pp. 38, 42.
1873. *Arbela* Stål, Enum. Hemip. iii. pp. 110, 111.
1873. *Acanthobrachys* Stål, Enum. Hemip. iii. p. 111.
1873. *Arbela* Walker, Cat. Hemip. Heter. Brit. Mus. vii. pp. 52, 144.
1896. *Arbela* Lethierry et Severin, Cat. Gén. Hémip. iii. p. 206.
1904. *Lorichius* Distant, Fauna Brit. Ind., Rhyn. ii. p. 402.
1905. *Acanthobrachys* Breddin, Mitt. Nat. Mus. (Hamb.) xxii. p. 145.
1908. *Arbela* Reuter, Mém. Soc. Ent. Belg. xv. pp. 104, 125.
1910. *Acanthobrachys* Distant, Fauna Brit. Ind., Rhyn. v. p. 219.
1911. *Arbela* Bergroth, Ann. Soc. Ent. Belg. lv. p. 187.
1915. *Arbelopsis* Poppius, Arch. Naturges. 80 (A 8), p. 5.
1925. *Arbela* Schroeder, Handb. d. ent. iii. p. 1055.

Type, *elegantula* Stål.

Slender to elongate, more or less shiny, pilose. Head horizontal, produced before and behind eyes. Eyes moderately large, prominent, only feebly immerged. Ocelli conspicuous. Antennæ long, slender, segments I and II usually subequal, each distinctly longer than head. Rostrum long, slender. Pronotum narrowed anteriorly, transversely constricted at or near the middle, the front lobe with a distinct ring-like collar. Scutellum subequilateral or longer than broad, always strongly impressed within the lateral margins along apical half, thus leaving a median ridge continuous with and behind the raised disc.

Hemelytra sinuate and ciliate along the costal margins; membrane with open cells, the veins sometimes indistinct. Legs long, slender, the femora usually tapering more or less uniformly from near the base, the anterior and intermediate femora and anterior tibiæ armed within along both anterior and posterior margins with a row of four or five long seta-like spines, the intermediate tibia similarly armed along its posterior margin. Hind tibiæ of male swollen near base in certain species. Anterior coxal cavities open behind, the coxæ not especially elongate. Metapleura dull; ostiolar canal shallow, placed much closer to posterior edge of pleuron than to anterior, its margin expanded, forming an oblong shiny area that extends outward almost to middle of pleuron.

The genus belongs to the tribe Nabini V. D. It is widely distributed in the Ethiopian, Oriental, and Australian realms, and apparently has its greatest affinities with certain species of the genus *Nabis* from the Neotropical realm. Present literature recognizes seven species, namely, *elegantula* Stål, *nitidula* (Stål), *polita* Stål, *costalis* Stål, *tabida* (Uhler), *virescens* (Kirkaldy), and *simplicipes* (Poppius). Uhler's species has proved to be synonymous with *nitidula*. To the six remaining may be added the ten new species described below.

Arbela elegantula Stål. (Fig. 2 *e*.)

1865. *Arbela elegantula* Stål, Hemip. Afr. iii. p. 42.
1873. *Arbela elegantula* Stål, Enum. Hemip. iii. p. 111.
1873. *Nabis elegantulus* Walker, Cat. Hemip. Heter. Brit. Mus. vii. p. 144.
1893. *Arbela elegantula* Bergroth, Rev. d'Ent. xii. p. 199.
1896. *Arbela elegantula* Lethierry et Severin, Cat. Gén. Hémip. iii. p. 206.
1908. *Arbela elegantula* Reuter, Mém. Soc. Ent. Belg. xv. p. 127 (in part).
1913. *Acanthobrachys elegantula* Distant, Trans. Linn. Soc. London, (2) xvi. p. 170.

Slender, shiny, the scutellum, disc of hemelytra, and meso- and metasternum duller, pale luteo-testaceous to testaceous, the antennæ, apices of femora, tibiæ in part, and tarsi darker. Two narrow divaricating lines on vertex, a spot on sides of collar, an irregular stripe along upper margin of propleura, a large triangular spot on each side of narrow pale median line of posterior lobe of pronotum, and sides and base of scutellum embrowned to testaceous. Hemelytra largely brownish testaceous, a spot at inner apical angle of corium and an irregular broad costal stripe pale, this pale area strongly widened distally before base of membrane. Membrane testaceous on basal half and down the middle of apical half, the sides pale. Venter stramineous, somewaht darkened at base and apex.

Head smooth, measured to collum barely longer than broad (18 : 17), the postocular part short; gula convex, clothed with long pale semierect hairs; vertex subequally as wide as an eye (6). Eyes dark, somewhat variegated, large, shorter than deep (9 : 10). Ocelli raised, conspicuous, subcontiguous, placed on a line drawn through hind margin of eyes. Collum arched, pale. Antennæ long, slender, the first segment very sparsely and others more thickly clothed with short, semirecumbent, pale pubescence; proportions, I : II : III : IV=29 : 35 : 53 : 32. Rostrum finely, sparsely pubescent, embrowned distally, the apex piceous; formula, II : III : IV=20 : 17 : 9.

Pronotum shiny throughout, slightly longer than broad (27 : 24), the sides straight and evenly converging from a point in front of humeri to base of collar; collar fairly long (4), distinctly, but finely rugulosely punctate; disc of anterior lobe suddenly raised above collar, impunctate, but with faint irregular impressions at the side in front; the transverse constriction shallow, sinuate, foveate at the middle, the posterior lobe arched, somewhat thickly punctate, the distance between adjacent punctures being subequal to their diameter. Scutellum longer than broad, with a few coarse punctures in basal and lateral impressions. Hemelytra with a few coarse punctures along the base of outer claval vein, the costal margin sinuate, ciliate along basal half; membrane reaching well beyond apex of abdomen, the veins fairly distinct. Margins of ostiolar canal flattened, strongly widened, the whole forming a shiny cordate area. Legs thinly pilose, the anterior femora about ten times as long as deep (50 : 5), their seta-like spines stout, brownish, in length equal to depth of femur; posterior femora and tibiæ with a few pale hairs whose length is not greater than diameter of femur at base, the tibiæ of male without evidence of enlargement along the basal third. First genital segment of male with a prominent, laterally projecting, piceous tooth on each side below apex of connexivum. Male clasper as in fig. 2 *e*.

Length 6·0–6·5 mm., width 1·12 mm.

The above description is made from a series of two females and four males, Silhouette, Seychelles, 1908 (British Museum) and one male, Mahé, Seychelles, 1909. The type (which I have not seen) is a female from Reunion (Bourbon) and is in the Stockholm Museum.

In 1893 Bergroth recorded a female from Mahé, Seychelles. Later Reuter, who had studied the type, recorded a female from Seychelles, a female from Katona, East Africa, and a male from Morogoro, Tanganyika (Dutch East Africa), and described the basal swelling on the hind tibia of the latter specimen. Since the Seychelles specimens described above (previously recorded by Distant without mention of the presence of male specimens) lack the tibial enlargement it is evident that two species have been confused in the literature under the name *elegantula*. In my failure to detect in the published records any criterion that might be used as a basis for deciding which of the two species represents the true *elegantula* I elected to apply Stål's name to the island-inhabiting species described above. Later, in returning specimens to the British Museum I wrote Mr. China of this problem, and am happy to state that he was able to secure the female type-specimen of *A. elegantula* Stål (through the courtesy of Professor O. Lundblad of Stockholm) for comparison with the Seychelles form. Mr. China states that the type is teneral, but that it has a different apperance and may be subspecifically distinct—the antennæ and legs are shorter and the size distinctly smaller. He feels, however, that we must wait until male individuals from Bourbon are obtained, and that in the meantime it is best to call the Seychelles form *A. elegantula*.

Arbela confusa, sp. n. (Fig. 2 *b*.)

1908. *Arbela elegantula* Reuter, Mém. Soc. Ent. Belg. xv. p. 127 (in part).

1910. *Arbela elegantula* Poppius, Sjöstedt's Kili-meru Exped. xii. (4) p. 59.

1920. *Arbela elegantula* Poppius, Voyage Alluaud et Jeannel, Hemiptera, iv. p. 318.

Closely resembling *elegantula*, from which it is differentiated by the slightly longer antennæ and legs, much more thickly and rugosely punctate hind lobe of pronotum, and the presence of a linear enlargemnt at the base of the hind tibiæ of the male.

Colour about as in *elegantula*, the sides of head behind eyes embrowned. Antennal proportions, 35 : 41 : 60 : 35. Pronotum shiny throughout, slightly more elongate than in *elegantula*, the two lobes not so roundly arched above, the hind lobe strongly, rugosely punctate (without flattened, smooth areas between the punctures). Anterior femora about twelve times as long as deep (60 : 5), posterior legs with longer hairs than in *elegantula*, the tibia of male with a linear enlargement along the basal third (fig. 2 *b*). First genital segment armed with piceous teeth.

Length 6·9 mm., width 1·13 mm.

Holotype, male, Uganda, Ruwenzori Range, Killembe, 4500 ft., Dec. 1934 to Jan. 1935, *F. W. Edwards* (British Museum). *Allotype*, female, taken with type.

Mr. China has examined a Kilimandjaro specimen (*cf.* Poppius, 1910) belonging to the Stockholm Museum, and finds it identical with *confusa*.

Arbela nitidula (Stål). (Figs. 2 *c*, 2 *d*.)

1859. *Nabis nitidula* Stål, Kongl-Svenska Freg. Eug. resa, Zool. iv. p. 261.
1865. *Arbela nitidula* Stål, Hemip. Afr. iii. p. 43.
1870. *Arbela nitidula* Stål, Öfv. Svenska Vet.-Akad. Förh. xxvii. no. 7, p. 674.
1873. *Arbela nitidula* Stål, Enum. Hemip. iii. p. 111.
1873. *Nabis nitidula* Walker, Cat. Hemip. Brit. Mus. vii. p. 145.
1896 . *Metatropiphorus tabidus* Uhler, Proc. U.S. Nat. Mus. xix. p. 268.
1896. *Arbela nitidula* Lethierry et Severin, Cat. Gén. Hémip. iii. p. 206.
1904. *Lorichius umbonatus* Distant, Fauna Brit. Ind., Rhyn. ii. p. 402, fig. 257.
1905. *Acanthobrachys nitidulus* Breddin, Mitteil. Naturhis. Museum, xxii. p. 145.
1908. *Arbela nitidula* Reuter, Mém. Soc. Ent. Belg. xv. p. 126.
1908. *Metatropiphorus tabidus* Oshanin, Verz. Palæ. Hemip. i. (2), p. 568.
1910. *Acanthobrachys nitidula* Distant, Fauna Brit. Ind., Rhyn. v. p. 220 (in part).
1913. *Arbela umbonata* Poppius, Ent. Tidskr. xxxiv. p. 258.
1914. *Arbela nitidula* Poppius, Tijd. v. Ent. lvi. p. 183.
1932. *Arbela tabida* Esaki, in Nippon Konchuzukan, Iconographic Insectorum Japonicum, p. 1669.

Colour and pattern about as in *elegantula*, the intensity of the darker markings strongly variable as in that species. Hind lobe of pronotum dull, the front lobe shiny. Head luteous to piceous, faintly longer than broad (17 : 15), the postocular part slightly shorter than in *elegantula*, the gula and vertex about as in that species. Eyes large ;

length : width : depth = 9 : 6 : 10. Antennal formula, 28 : 30 : 52 : 37. Rostrum, 19 : 16 : 7. Pronotum scarcely longer than broad (25 : 24), the hind lobe much duller than front lobe, coarsely punctate. Scutellum barely longer than broad, with a few punctures near base and in the lateral impressions. Hemelytra about as in *elegantula*. Anterior femora not more than ten times as long as deep (48 : 5), their spines stout and faintly longer than greatest depth of femur. Posterior tibiæ pilose, with a row of four very long fine setæ on the dorsal surface, the male with a large nodular enlargemnet (fig. 2 *c*) along the basal fourth. Last segment of abdomen of male with a stout black tooth on each side just below apex of connexivum, this tooth shorter and stouter than that in *elegantula*. Male clasper (fig. 2 *d*) of the same general type as in *elegantula*, but smaller and slightly different in proportions.

Length 5·7–6·3 mm., width 1·00–1·15 mm.

Nitidula is the most widely distributed species of the genus. Stål's type was from Manila, Philippine Islands. Forty-one specimens belonging to the C. F. Baker collection (U.S. N. M.) are at hand from Mt. Maquiling and Los Banos, Laguna Province, Luzon ; Mt. Banahao, Luzon ; Kolambugan, Lana Province, and Tangoolan, Bukidnon Province, Mindanao, P. I. ; and Sandakan, Borneo. I have specimens from Manilla and Java. Also there is before me a nice series of males, females, and nymphs from Sarawak (Mt. Dulit, 2500 ft., 1932, British Museum) and another series from New Hebrides (Malekula, 1930, *L. E. Cheesman*, British Museum). In the Deutsche Ent. Museum there is a male from Kanthaley, Ceylon, which I referred to this species a few years ago. Poppius has recorded the species from Borneo, Sumatra, New Guinea, and New Hebrides. Its synonym (*L. umbonatus* Dist.) is listed from Ceylon, Bengal, Annam, Tenasserim, and New Guinea. I am much indebted to Mr. H. G. Barber of the U.S. National Museum for comparing Uhler's type of *tabidus* from Japan with specimens of *nitidula* from the Philippines and the sketches presented with this study. He reports that he concludes that they are the same, " although *tabidus* has the posterior lobe of the pronotum a little more densely punctate," and states further that "it also runs to *nitidula* in the key, but the small black-tipped spine of the connexivum is rather obscure owing to the mutilated condition of the male specimen."

It should be noted that the species is strongly variable as to the extent and intensity of the darker markings. Some of the examples from Sarawak, for instance, have the head entirely piceous black and the pronotum, except for a small area each side on the hind lobe, black. Likewise the hemelytra in some are quite dark.

Arbela deusta, sp. n.

Colour and markings as in pale specimens of *nitidula*. Antennal proportions, 31 : 33 : 57 : 37. Eye, 8 : 5 : 9. Pronotum faintly longer than broad, the hind lobe dull and punctured as in *nitidula*. Hemelytra and front legs as in *nitidula*; the basal enlargement of posterior tibia longer, less globose, and distinctly impressed on its inner (posterior) surface along the basal portion. Male genital segment without teeth below apex of connexivum. Clasper (fig. 2 *f*) distinctly smaller and slightly differently shaped than that in *nitidula*.

Holotype, male, Peradoniya, Ceylon, 5, 1904 (British Museum).

This species is closely related to *nitidula*. I had considered it to represent Distant's *Lorichius umbonatus* until Mr. China wrote that the types of that form possess teeth on the venter.

Arbela polita Stål.

1870. *Arbela polita* Stål, Öfv. Svenska Vet.-Akad. Förh. xxvii. no. 7, p. 675.
1873. *Arbela polita* Stål, Enum. Hemip. iii. p. 111.
1896. *Arbela polita* Lethierry et Severin, Cat. Gén. Hémip. iii. p. 206.
1931. *Arbela polita* Esaki, Bull. Biogeographical Soc. Japan, ii. p. 212.

Fusco-æneous; the membrane fuscous, distal three antennal segments testaceous, basal antennal segment and legs flavo-testaceous, the femora with a dark band before apex. Pronotum highly polished throughout, the apical stricture obsolete and the median constriction shallow; hind lobe with a few extremely fine punctures which in certain lights are invisible. Male with a small tooth on each side of venter and a prominent enlargement at base of hind tibiæ.

Head smooth, polished, somewhat paler distally, usually with two divaricating darker streaks running forward from the ocelli, slightly longer than broad (20 : 18);

vertex (7) flat; gula less tumid than in *elegantula*. Eye narrower than vertex, a little longer than in *nitidula* and not projecting above vertex; proportions, length : width : depth = 10 : 6 : 10. Antennæ clothed as in *elegantula* and *nitidula*; proportions, 27 : 31 : 55 : 36. Rostral formula, 22 : 17 : 8. Pronotum longer than broad (♂, 30 : 23), collar indistinctly delimited; sides before median stricture almost straight, barely converging anteriorly; posterior lobe only slightly raised above anterior lobe. Scutellum slightly longer than broad. Hemelytra shiny, with a few scattered, fine pale hairs, the lateral margins sinuate and ciliate. Anterior femora only about ten times as long as deep (51 : 5), their seta-like spines stout and in length distinctly greater than depth of femur. Posterior tibiæ distinctly longer than in *nitidula*, but clothed as in that species, the nodular enlargement not so stout, occupying about the basal one-fourth. Teeth at apex of venter in male about as in *nitidula* but somewhat smaller. Male clasper of the typical y-shape.

Length 6·5–7·0 mm., width 1·0–1·1 mm.

Fourteen specimens are at hand from the C. F. Baker collection (U.S. National Museum), twelve from Mt. Maquiling, Luzon; one from Malinao, Tayabas Province, Luzon; and one from P. Princess, Palawan. The species is known only from the Philippines and Botel Tobago Island, S. Formosa (Esaki). As Stål pointed out, *polita* is a longer species than *nitidula*, and may be recognized by colour as well as by the structural characteristics. The membrane shows some evidence of the pale markings characteristic of other species. In some specimens reddish to crimson flecks may be seen through the scutellum and pronotum. The male genital segment is clothed beneath with long hairs and a thick coat of velvety pile as in related species. Stål's types were from the Philippines.

Arbela pacifica, sp. n.

Very similar to *polita* Stål, from which it differs chiefly in its darker colour and the coarse punctuation of the pronotum. Fuscous-brown, the scutellum, lateral margins of membrane, antennæ, rostrum, front acetabula, and legs paler, flavo-testaceous to testaceous. Head about as in *polita*, the vertex (6) a little narrower. Eye as wide as vertex. Antennal proportions, 33 : 35 : 62 : 42. Rostral formula, 20 : 18 : 9. Pronotum constricted at the middle as in *polita*, the collar long and obsoletely delimited as in that species, the hind lobe more strongly arched and with scattered coarse punctures. Scutellum longer than broad. Hemelytra with a few short, pale, almost erect hairs, the margins as in *polita*. Wing without hamus. Shiny rim of ostiolar canal widened, cordate, almost as broad as long. Legs as in *polita*, the hind tibiæ of female with very long fine hairs, the enlargement of hind tibia of male slightly shorter than in *polita*. Tooth at apex of venter in male small and inconspicuous. Clasper smaller than in *polita* and with slightly differently formed blade, the " thumb " short and recurved.

Length 6·0–6·8 mm., width 0·93–1·10 mm.

Holotype, male, and *allotype*, female, Sandakan, Borneo, *C. F. Baker* (U.S. National Museum). *Paratypes*, one male and three females, taken with type ; and one male, taken on leaves in undergrowth, secondary forest, junction of rivers Tinjar and Lejok, foot of Mt. Dulit, Sarawak, *B. M. Hobby* and *A. W. Moore* (British Museum).

Arbela virescens (Kirkaldy).

1908. *Acanthobrachys virescens* Kirkaldy, Proc. Linn. Soc. New South Wales, xxxii. p. 782.

A single female individual, Maleny, Queensland, January 1, 1925, *H. Hacker*, is referred to this species. This specimen agrees quite well with Kirkaldy's description. The pronotum, except disc of hind lobe, and the lateral area of the hemelytra are quite green and the femora are distinctly greenish in hue. The membrane is smoky, with a distinct pale fascia behind apex of corium. Structurally *A. bakeri*, sp. n., is unquestionably very closely related to this form.

Known heretofore only from the type, a female from Kuranda, Queensland, Australia, now in the collection of the Hawaiian Sugar Planters' Association.

Arbela bakeri, sp. n.

Smaller and slenderer than *elegantula*, general colour about as in that species but the markings on pronotum different. Structurally, apparently nearest *virescens*. Head pale (with divaricating lines above) or completely infuscated. Sides of thorax, front lobe of pronotum, scutellum, and hemelytra (except broad lateral margins) sometimes more or less embrowned to fuscous. Posterior lobe of pronotum often with a large, nearly semicircular, infuscated patch before base of scutellum.

Head about as broad as long (16 : 17), the vertex broader than in *elegantula*, it and gula arched. Eyes smaller than in *splendida* and *elegantula*; proportions, length : width : depth=8 : 5 : 8. Ocelli smaller than in *splendida*, separated by a groove as in that species. Antennæ long and clothed as in *splendida*; proportions, 42 : 55 : 60 : 45. Rostral formula, 21 : 16 : 8. Pronotum slightly longer than broad (27 : 23), constricted well before the middle; collar punctate, sharply delimited; disc of anterior lobe smooth, about two-thirds as long as wide (9 : 15), longitudinally sulcate as in *splendida*; posterior lobe shiny, arched, coarsely and thickly punctured in front, the punctures fading out on the infuscated area before base of scutellum. Scutellum barely longer than broad. Ostiolar canal linear as in *splendida*. Anterior femora about fourteen times as long as deep (57 : 4), the seta-like spines pale and very fine. Posterior tibiæ of male not enlarged basally. Venter of male without tooth at sides below apex of connexivum. Male clasper with short recurved " thumb " and very slender, tapering blade.

Length 5·8–6·3 mm., width 1·0–1·1 mm.

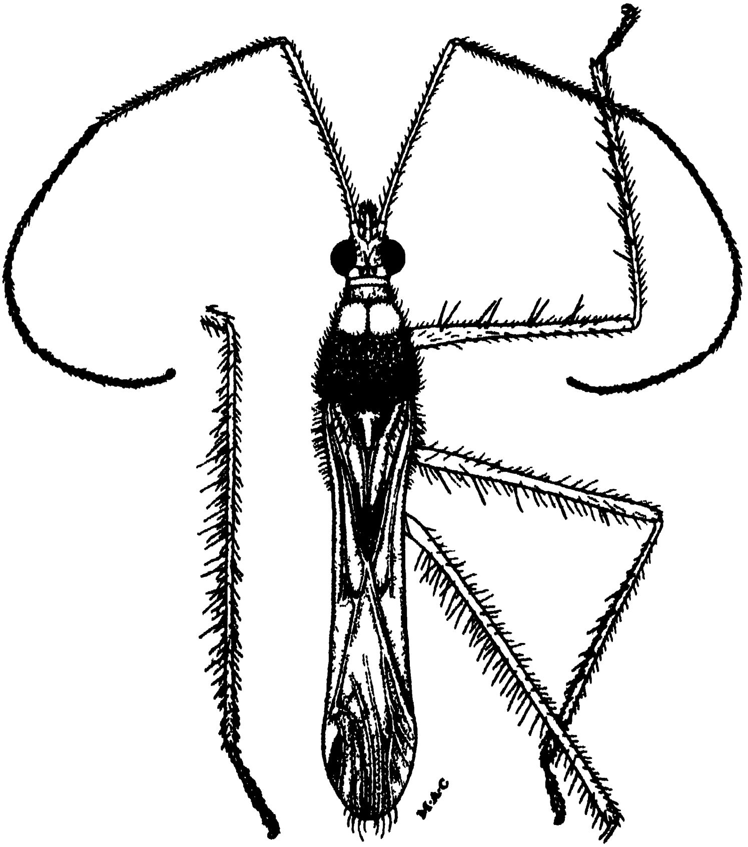
Holotype, male, and *allotype*, female, Singapore, *C. F. Baker* (U.S. National Museum). *Paratypes*, one female and one male (mutilated), taken with types; two females, Sandakan, Borneo, *C. F. Baker*; one male, island of Penang, Straits Settlements, *Baker*; one female, Imugan, Nueva Viscaya Province, Luzon, P. I., *Baker*; one female, Surigao, Mindanao, P. I., *Baker*; and three males and four females, Dunk Island (Australia), August 25, 1927, *H. Hacker*.

This distinct species is clothed on pronotum and hemelytra with scattered, almost erect, pale hairs as in *splendida*. The legs also are clothed as in that species. The veins of the membrane are distinct and the wing is without the hamus. Some of the Dunk specimens have a decided greenish cast and the membrane is pale at apex of corium.

Arbela splendida, sp. n. (Fig. 1.)

Head, first antennal segment, broad costal margin of hemelytra, rostrum (except apex), venter, prosternum, and legs (except apices of femora, tibiæ, and tarsi) ochraceous to greenish testaceous. Pronotum largely pale green. Meso- and metapleura, a stripe on propleura extending forward on collar, distal three antennal segments, scutellum (except median ridge toward apex), base of clavus, a spot on each side of pronotum in front of base

Fig. 1.



Arbela splendida, sp. n., female.

of clavus, and tips of rostrum, tibiæ, and tarsi fuscous. Knees and disc of hemelytra embrowned. Eyes, ocelli, collum, and most of abdomen above, sanguineous.

Head smooth, shiny, with fine hairs above, faintly longer before basal stricture than broad (20 : 19), the postocular part very short; gula arched, thickly clothed with long, pale upright hairs; vertex moderately broad (7). Eyes large, not projecting above vertex; length : width : depth=9 : 6 : 8. Ocelli strongly raised, subcontiguous. Antennæ long, segment I sparsely, and other segments thickly, clothed with short, pale pubescence; proportions, 53 : 60 : 74 : 45. Rostrum finely, sparsely pubescent; formula, II : III : IV=27 : 20 : 8. Pronotum (fig. 1) only faintly longer than broad (30 : 29); constricted distinctly before the middle, the length to constriction equal to width across collar (14); the disc of front lobe suddenly raised behind collar, smooth, shiny, prominently sulcate down the middle; hind lobe arched, shiny, coarsely, somewhat rugosely punctate, the punctures becoming finer on the declivent base. Scutellum depressed behind base and along each side. Hemelytra not so shiny as head and pronotum, clothed with a few fine pale hairs, the concave lateral margins strongly ciliate along basal half; membrane reaching beyond apex of abdomen, the veins fairly distinct, the inner cells open at apex. Margins of metasternal canal pale, raised, elongate, the shiny area linear, not greatly widened as in *elegantula*. Legs conspicuously pilose, the anterior femora, as seen from the side, about fourteen times as long as deep (71 : 5); the seta-like spines pale, much finer than in *A. elegantula*; hind femora and tibiæ clothed within with long, semierect, pale hairs the length of which is subequally as great as that of an eye. Venter swollen distally, reflexed along sides so as to form a narrow but deep trough-like groove below the horizontal connexivum; ovipositor very stout.

Length, female, 6·9 mm., width 1·17 mm.

Holotype, female, Kokoda, Papua, 1200 ft., vi. 1933, *L. E. Cheesman* (British Museum). A second female, Mafulu, Papua, 4000 ft., i. 1934, *L. E. Cheesman*, apparently represents this species. This latter specimen is teneral and badly shrunken and discoloured.

Differs from *elegantula* in colour and in its longer antennæ and legs (fig. 1), more numerous and much longer hairs on legs, more widely separated ocelli, shorter postocular part of head, shorter pronotal collar, and sulcate front lobe, more coarsely and rugosely punctate posterior lobe and sinuate lateral margins of pronotum.

Arbela cheesmanæ, sp. n.

Very elongate, slender, shining, the legs and antennæ long and conspicuously pilose. Flavo-testaceous, the eyes and ocelli, a median spot on collum above, an oblique line across each side of disc of posterior lobe of pronotum, the clavus (except outer part along basal third), an irregular posteriorly widened stripe along apical half of inner corial vein, a streak along membranal suture, the outer apical angle of corium, apical rings on all femora, and the base of posterior tibiæ bright reddish to crimson. A stripe along each side of disc of anterior lobe of pronotum (continued and widened on collar), a small spot on humeri, the scutellum in large part, a transverse oval spot across corium at inner apical angle (not reaching costal margin), a spot across middle third of membrane, and a median spot at apex of membrane brownish testaceous. The basal antennal segment flecked with reddish, the distal half of segment III and all of segment IV, the apex of rostrum, apical rings on all tibiæ, and the tarsi testaceous to fusco-testaceous.

Head, measured to collum, distinctly longer than broad (22 : 16); postocular part parallel-sided, its length greater than width of vertex; gula feebly arched and conspicuously pilose; vertex as wide as an eye. Eyes small for the genus, as long as deep (7). Ocelli only moderately large, slightly separated and placed distinctly behind a line drawn through posterior margin of eyes. Antennæ long, segment I stout, conspicuously clothed with almost erect, dark stiff hairs, the length of these hairs easily twice as great as the diameter of the segment where they arise, other segments clothed as in *elegantula* and related species; proportions, 57 : 60 : 45 : 56. Rostrum with numerous long, almost erect hairs on segment II; formula, 23 : 18 : 10.

Pronotum longer than broad (28 : 26), the collar indistinctly punctate; disc of the anterior lobe about as long as broad, slightly narrowed anteriorly, shiny, impunctate; posterior lobe strongly raised and strongly widened posteriorly, shiny, coarsely, somewhat rugosely punctate. Scutellum impressed near base and along sides as in other species. Hemelytra with the costal margin strongly concave and ciliate as in other species; membrane long, reaching beyond apex of abdomen. Propleura punctate, the acetabula smooth. Shiny rim of metastethial orifice pale, distinctly transverse. Legs long, slender; the femora about equally swollen at base and apex, thinnest at a point slightly beyond the middle, thickly clothed with long, almost erect pale hairs, the anterior and intermediate ones and their tibiæ armed within with slender spine-like setæ. Posterior tibiæ not enlarged basally. Venter with a keel along basal segments. Male clasper very small, with short stem, the dorsal prong ("thumb") stout, incurved at the tip, the lower prong longer and slenderer. Ovipositor large, prominent.

Length 7·8–8·9 mm., width 1·1–1·2 mm.

Holotype, male, and *allotype*, female, Mafulu, Papua, 4000 ft., i. 1934, *L. E. Cheesman* (British Museum).

This beautiful species may be recognized at once by its long and slender body and the colour-markings, as well as by the nature of the head, antennæ, eyes, legs, and male clasper.

Arbela insularis, sp. n.

Pale green, fading to stramineous, the antenniferous ubercles laterally, an oblong spot on each side behind eyes, the base and apex of antennal segment I, the apex of II, apical three-fourths of III, and all of IV, tip of rostrum, apical ring of hind femora and tibiæ, and apices of tarsi brownish testaceous to piceous; a small spot on front of collar at the sides and a wide median stripe extending from tip of membrane to scutellum and there dividing and continuing along each side of scutellum and obliquely on disc of hind lobe of pronotum, smoky brown. Head and anterior lobe of pronotum shiny, the posterior pronotal lobe and hemelytra duller.

Head longer than broad (21 : 17), smooth, the postocular part moderately long, parallel-sided; vertex (8) much wider than an eye (4·5); gula only slightly arched, clothed with a few long, pale hairs. Eyes small; proportions, length : width : depth = 7 : 4·5 : 7. Ocelli small, contiguous, placed behind a line drawn through posterior margin of eyes. Antennæ moderately long, segment I sparsely and inconspicuously clothed with short pale hairs; proportions, 37 : 40 : 57 : 37. Rostral formula, 25 : 22 : 10. Pronotum slightly broader than long (33 : 31), constricted before the middle, its width across collar equal to length of stricture (14); the disc of the anterior lobe impunctate, transverse, strongly widened posteriorly; the constriction with a median fovea, the hind lobe dull, strongly raised and arched, thickly, finely, shallowly punctate. Scutellum equilateral, the basal and lateral impressions broader and shallower than in *elegantula*. Hemelytra ciliate along the sides before the middle. Ostiolar canal with its front margin strongly widened, the shiny area distinctly longer than wide. Anterior femora about ten times as long as deep (60 : 6), the seta-like spines darkened, fairly stout, and apparently only four to the row. Hind tibiæ with numerous very long fine hairs.

Length 7·6 mm., width 1·43 mm.

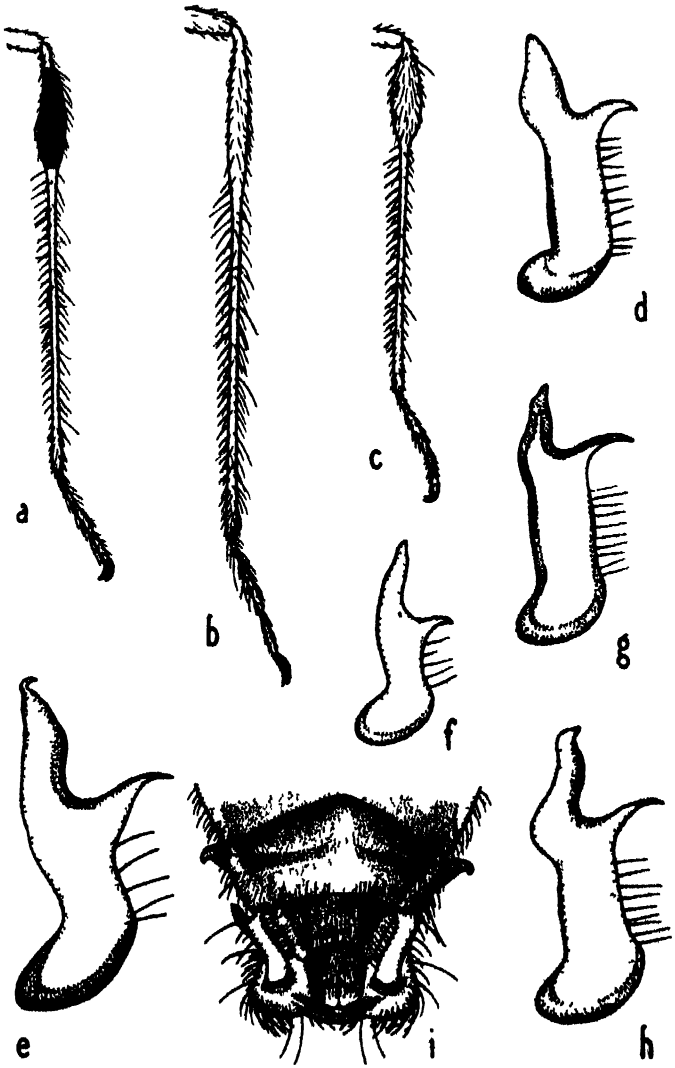
Holotype, female, Mafulu, Papua, 4000 ft., xii. 1933, *L. E. Cheesman* (British Museum). Recognized at once by its green colour with the darker stripe down the back, small eyes, and produced and parallel-sided post-ocular part of head.

Arbela papuana, sp. n. (Fig. 2 *h*.)

Somewhat similar to typical *costalis* in colour and pattern and in the presence of abdominal tooth and absence of tibial enlargemnet in the male, but differing from it in size, shape of pronotum, which has the hind lobe much less shiny and very coarsely punctate, and in the form of the male clasper (fig. 2 *h*).

Head, thorax, scutellum and a broad stripe down middle of hemelytra black; a stripe beginning on humeri and continuing along hemelytra to end of membrane, a spot on both collum and collar beneath, and the front margin of anterior acetabula whitish testaceous; first antennal segment, rostrum, and legs, flavo-testaceous; the distal antennal segments fuscous. Head faintly broader than long (18 : 17), the postocular part fairly long, slightly narrowed backwards. Eyes large, equally as wide as and projecting above vertex; proportions, length : width :

Fig 2.



a, hind tibia of male *A. deusta*, sp n.; *b*, hind tibia of male *A. confusa*, sp. n.; *c*, hind tibia of male *A. nitidula* (Stål); *d*, left male clasper, *A. nitidula* (Stål); *e*, left male clasper, *A. elegantula* Stål; *f*, left male clasper, *A. deusta*, sp. n.; *g*, left male clasper, *A. costalis* Stål, *h*, left male clasper, *A. papuana*, sp. n; *i*, genital segments, dorsal view, *A. inerma*, sp n depth=8 : 6 : 10. Ocelli on a common rounded prominence. Antennæ with a few short pale hairs on segment I; proportions, 32 : 31 : 55 : 40. Rostral formula, 20 : 17 : 8. Pronotum as broad as long (♂ 25 : 25), constricted at the middle; disc of the anterior lobe smooth, shiny, sharply raised above collar; the posterior lobe only faintly shiny, coarsely and deeply punctate. Hemelytra sinuate and ciliate along costal margin; membrane with veins fairly prominent, the two outer cells open at apex. Scutellum as broad as long, impressed as in other species.

Legs moderately long, strongly pilose, the hairs of the hind tibiæ of female longer and more nearly erect than in *costalis*; anterior femur about nine times as long as deep (54 : 6), its seta-like spines darkened, stout, not longer than its depth. Ostiolar canal with the shiny area straight, almost parallel-sided, and about twice as long as wide. Venter darkened at base, with a small black tooth below apex of connexivum. Male clasper as in fig. 2 *h*.

Length 6·0–7·0 mm., width 1·1–1·3 mm.

Holotype, male, and *allotype*, female, Kokoda, Papua, 1200 ft., 1933, *L. E. Cheesman* (British Museum). There is a third specimen (female) without head.

Arbela immista, sp. n.

Much like *A. papuana*, sp. n., but smaller, the posterior lobe of pronotum more distinctly matt and entirely black, its punctures finer, more sparsely spaced and much shallower, and with ventral abdominal tubercles very small and pallid.

General coloration as in *papuana*, the pale costal stripe not encroaching on pronotum, the antennæ entirely fuscous, the pronotal collar beneath and anterior acetabula without pale markings; abdominal venter pale except at base. Head faintly broader than long (16 : 15). Eyes approximately as in *papuana*, though slightly smaller. Vertex broader than an eye (6 : 5·5). Antennal proportions, (♂) 30 : 28 : 47 : 36. Pronotum faintly broader than long; the anterior lobe smooth, strongly shiny, sharply raised behind the collar; posterior lobe, except fine anterior and posterior margins, dull, moderately sparsely, finely punctate. Legs with the tibiæ and tarsi and apices of femora darkened; anterior femora about nine times as long as deep (46 : 5). Venter with a very tiny, almost obsolete, pale tubercle on each side below apex of connexivum. Male clasper slightly smaller than that of *A. papuana* and differently proportioned.

Holotype, male, and *allotype*, female, New Hebrides: Ounua, Malekula, March and April, 1929, *L. E. Cheesman* (British Museum). *Paratypes*, ten males and females, Malekula, February–May and December, 1929.

Arbela inerma, sp. n.

Colour and pattern as in *elegantula*, the darkened patches on pronotum extending forward on disc of anterior lobe, the antennæ entirely testaceous to fuscous. Head longer than broad (21 : 18), the postocular part long, parallel-sided. Eyes moderately large; length : width : depth=8 : 6 : 9. Antennæ slender, the few hairs on first segment very fine and semirecumbent; proportion of segments, 44 : 45 : 73 : 45. Rostral formula, 25 : 20 : 9. Pronotum as broad as long (28 : 28), constricted before the middle, the collar punctate, sharply delimited; posterior lobe strongly raised above anterior, dull, moderately coarsely, uniformly punctate. Scutellum longer than broad. Hemelytra as in related forms; the membrane large, with prominent veins. Ostiolar rim broad. Legs rather conspicuously clothed with long hairs, the apical bands of femora prominent; anterior femur about ten times as long as deep (62 : 6), its seta-like spines stout, dark. Hind tibiæ of male with long pale setæ; not enlarged at base. Teeth on venter of male (fig. 2 *i*) larger than in other species and prominently recurved.

Length 7·0–7·6 mm., width 1·0–1·3 mm.

Holotype, male, and *allotype*, female, Kokoda, Papua, 1200 ft., May 1933, *L. E. Cheesman* (British Museum). *Paratypes*, four males and seven females, taken with types and at type-locality in June, August, and September.

Arbela simplicipes (Poppius).

1915. *Arbelopsis simplicipes* Poppius, Arch. Naturges. lxxx. (A 8) p. 6.

1926. *Arbelopsis simplicipes* Esaki, Ann. Mus. Nat. Hung. xxiv. p. 169.

Known only from Formosa. I have a female co-type which was kindly made available through the courtesy of Doctors Walther Horn and Hans Sachtleben of the

Deutsches Entomologisches Institut der Kaiser Wilhelm, Gesellschaft.

Arbela costalis Stål. (Fig. 2 *g*.)

1873. *Arbela costalis* Stål, Enum. Hemip. iii. p. 111.
1896. *Arbela costalis* Lethierry et Severin, Cat. Gén. Hémip. iii. p. 206.
1930. *Arbela costalis* China, Insects of Samoa, II. Hemiptera, p. 156.

This species is easily recognized by its black colour, with broad pale costal stripes of hemelytra, small size, sharply marked-off pronotal collar, shiny posterior lobe of pronotum which is sparsely finely punctate, and short first antennal segment. Mr. China was the first to establish definitely that the males do not have basal thickenings on the hind tibiæ. The species was described from Ovalau, Fiji Islands. I have seen a female specimen from Samoa (determined by Reuter and kindly sent for study through the courtesy of Dr. Edward Wagner, Das Zoologische Staatinstitut und Zoologische Museum, Hamburg). China recorded many specimens from various islands in the Samoan group, and described the variety *flavicollis*.

There are before me several males, females, and nymphs from Fiji, collected by Dayton Stoner, and also a series of eleven specimens taken by Miss L. E. Cheesman on the islands of Malekula, Erromanga, and Banks Island, New Hebrides. These latter specimens and a portion of those from Fiji differ from the typical variety in that the white markings of the pronotum extend along the sides for the full length of the posterior lobe.

Key to Species of Arbela.

1.	Male (*virescens*, *splendida*, and *insularis* unknown)	2.
	Female (*deusta* unknown)	15.
2.	Genital segment armed with a more or less prominent tooth on each side below apex of connexivum (fig. 2 *i*)	3.
	Genital segment without tooth	12.
3.	Tibia of posterior leg suddenly and conspicuously swollen along basal third (figs. 2 *a*–*c*)	4.
	Hind tibia not enlarged basally	7.
4.	Tibial enlargement linear and not greater in thickness than apex of femur (fig. 2 *b*). Body-colour flavo-testaceous to testaceous	*confusa*, sp. n.

	Tibial enlargement not as above (if somewhat linear then entire body dark, fuscous to æneo-fuscous)	5.
5.	Posterior lobe of pronotum somewhat shiny, but still noticeably duller than anterior lobe	*nitidula* (Stål).
	Posterior lobe of pronotum equally as shiny as anterior	6.
6.	Hind lobe of pronotum smooth (with a few very minute almost indistinguishable punctures)	*polita* Stål.
	Hind lobe of pronotum with scattered, conspicuous punctures	*pacifica*, sp. n.
7.	Posterior lobe of pronotum noticeably duller than anterior lobe	8.
	Pronotum strongly shiny throughout	10.
8.	Length of first antennal segment less than twice diameter of head through eyes. Head, pronotum, scutellum, and hemelytra (except broad costal margins) black.	9.
	Length of antennal 1 more than twice diameter of head through eyes. Colour not black	*inerma*, sp. n.
9.	Ventral abdominal tubercles very small, almost obsolete. Pronotal punctures sparsely spaced, fine and shallow. Pronotum entirely black	*immista*, sp. n.
	Ventral abdominal tooth prominent. Pronotal punctures numerous, coarse and relatively deep. Humeri pale	*papuana*, sp. n.
10.	Posterior lobe of pronotum with only a few, scattered punctures. Colour largely black (*costalis* Stål)	11.
	Hind pronotal lobe rather thickly punctate. Colour testaceous	*elegantula* Stål.
11.	Pronotum, except for humeri, black	Var. *costalis* Stål.
	Hind lobe of pronotum largely pale	Var. *flavicollis* China.
12.	Hind tibia swollen basally (figs. 2 *a*, 2 *f*). Posterior lobe of pronotum not so shiny as anterior lobe	*deusta*, sp. n.
	Posterior tibia without basal enlargement. Pronotum shiny throughout	13.
13.	Hairs of antennal I numerous, long, almost erect, their length about equal to diameter of an eye. Eyes not longer than broad	*cheesmanæ*, sp. n.
	Hairs of antennal I few, or their length not more than half of the diameter of an eye. Eyes obviously longer than broad	14.
14.	Distance from front margin of eye to apex of antenniferous tubercle subequal to length of an eye. Postocular part of head long, parallel-sided	*simplicipes* (Poppius).
	Eyes conspicuously longer than distance between it and apex of antenniferous tubercle. Postocular part of head short and slightly obliquely narrowed to collum	*bakeri*, sp. n.
15.	Outline of eye as seen from above circular, not longer than broad. Length of first	

antennal about three and half times as great as width of head through eyes ... *cheesmanæ*, sp. n.

Eyes obviously longer than broad. Length of antennal 1 less than three times as great as diameter of head through eyes .... 16.

16. Width of an eye barely more than half of vertex .... *insularis*, sp. n.

Width of eye equal to or almost equal to that of vertex .... 17.

17. Length of eye distinctly greater than distance from its front margin to apex of antenniferous tubercle............. 18.

Eye-length subequal to distance between its front margin and apex of antenniferous tubercle...................... *simplicipes* (Poppius).

18. Length of first antennal distinctly more than twice as great as width of head through eyes .... 19.

Length of first antennal less than twice as great as width of head through eyes . 21.

19. Posterior lobe of pronotum distinctly duller than anterior lobe .... *inermis*, sp. n.

Pronotum strongly shining throughout .. 20.

20. Yellowish-testaceous. Punctures of posterior lobe indistinct in front of scutellum, leaving a large area apparently smooth, this area usually darkened .... *bakeri*, sp. n.

Greenish testaceous. Posterior lobe regularly punctate on disc (fig. 1) .... 29.

21. Hind lobe of pronotum distinctly duller than anterior lobe .... 27.

Pronotum equally shiny throughout ..... 22.

22. Colour fuscous to æneo-fuscous. Posterior lobe of pronotum smooth or with only a few scattered punctures, the distance between the punctures greater than their diameter .... 23.

Colour paler, flavo-testaceous to testaceous. Posterior lobe of pronotum more closely punctate......................... 26.

23. Apical stricture of pronotum obsolete ... 24.

Pronotal collar sharply delimited, the transverse impression sharply defined. . 25.

24. Hind lobe of pronotum smooth, apparently impunctate, however, with a few very fine minute punctures............ *polita* Stål.

Hind lobe of pronotum with scattered, conspicuous coarse punctures .... *pacifica*, sp. n.

25. Pronotum, except for humeri, black ..... Var. *costalis* Stål.

Hind lobe of pronotum largely pale ..... Var. *flavicollis* China.

26. Posterior lobe rugulosely punctulate, the punctures fine and contiguous .... *confusa*, sp. n.

Punctures of posterior lobe of pronotum fewer, more sharply defined, not contiguous .... *elegantula* (Stål).

27. Hind lobe of pronotum distinctly longer than front lobe. Colour testaceous to fusco-testaceous, at times black with pale costal borders, but then the scutellum

and usually pronotum with a pale median line .... *nitidula* (Stål).
Two lobes of pronotum subequal in length. Colour black, the broad costal margin of hemelytra paler .... 28.
28. Pronotum entirely black, its punctures relatively fine and shallow .... *immutata*, sp. n.
Humeri pale. Pronotal punctures much coarser, more numerous and deeper .. *papuana*, sp. n.
29. Disc of front lobe of pronotum scarcely more than one-half wider than long; posterior lobe more finely punctate..... *virescens* (Kirk.).
Anterior lobe of pronotum, excluding collar, twice as broad as long: posterior lobe much more coarsely punctured (fig. 1). Eyes larger .... *splendida*, sp. n.

LXVI.—*Five new Asiatic* Telenominæ (*Hym., Proctotrupoidea*). By G. E. J. Nixon, B.A., Imperial Institute of Entomology.

I am describing below four species in *Telenomus* (s. str.) and one in its subgenus *Aholcus*.

The types are in the British Museum.

The material is interesting because the four species which I now place in *Telenomus* seem to invalidate the chief character (*i. e.*, presence or absence of hairs on eyes) on which I tried to base a division between this genus and the closely allied *Microphanurus* (Trans. R. Ent. Soc. Lond. lxxxiii. p. 74, 1935, and Ann. & Mag. Nat. Hist. xx. p. 116, 1937). According to the summary of differences given in the earlier paper, there is no doubt that the four new species in question are rightly placed in *Telenomus*.

Later on, I hope to be able to offer a redefinition of the two genera.

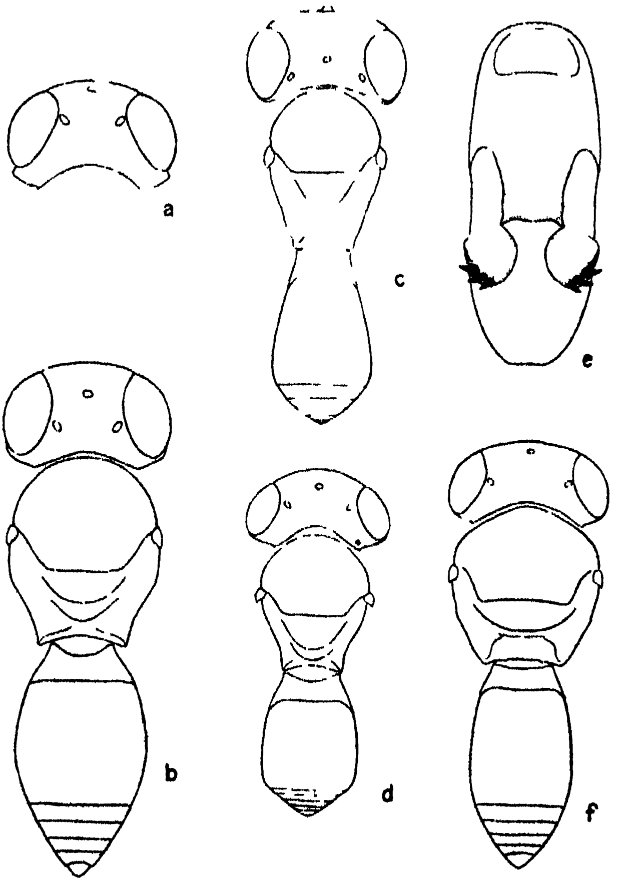
Subfamily *Telenominæ*.

Telenomus usipetes, sp. n. (Fig. 1, *d*.)

♂♀. Brownish black, the abdomen slightly paler. Legs, except the anterior coxæ, whitish yellow. Except for the apical 4 segments of the ♀ antenna, which are darkened, antennæ in both sexes more or less same colour as the legs.

♀. *Head* markedly wider than the thorax. Frons almost everywhere smooth, shining. Vertex between the ocelli shining, with hardly a trace of sculpture; behind the ocelli rather sharply declivous. Shortest distance between the eyes to their width as seen from above, as 6 : 5.

Fig 1.



(*a*) *Telenomus olynthus*, sp. n., head of ♀ (from above and slightly from behind); (*b*) *Telenomus olynthus*, sp. n., body of ♀; (*c*) *Telenomus ochus*, sp. n., body of ♀; (*d*) *Telenomus usipetes*, sp. n., body of ♀; (*e*) *Telenomus usipetes*, sp. n., genitalia of ♂; (*f*) *Telenomus periporetus*, sp. n., body of ♀. All, except (*e*), drawn to the same scale.

Antennæ rather long (fig. 2, *h*); funicle 1 very slightly longer than wide; club sub-5-segmented. Eyes with scattered, excessively short hairs, just discernible at magnification of (× 60).

Thorax not at all flattened, short and high in profile. Mesonotum feebly shining, its sculpture very weak and quite indefinite. Scutellum convex, smooth and shining, not markedly transverse. Postscutellum rugulose. Wings very pale ; venation pale, indistinct ; hind wings virtually parallel-sided beyond the nervature, their fringe slightly longer than their greatest width. Legs fairly slender ; segment 1 of the middle tarsus nearly four times as long as wide.

Abdomen about one and a half times as long as wide. Tergite 1 strongly transverse, with a row of foveæ at base ; 2 striate at extreme base, the striæ quite inconspicuous.

♂. Funicle rather thick (fig. 2, *g*) ; funicles 1 and 2 hardly differentiated from rest ; funicles 5–9 bead-like, rather closely articulated. Genitalia (fig. 1, *e*) unusually short and quite unlike that of any other *Telenomus*, whether Asiatic of African, that I have described ; the usual darkened struts on the " ventral plate " to which the apical appendages are articulated are not differentiated, the ventral plate itself showing an even sclerotisation.

Length, ♂♀, about ·5 mm.

BURMA : Pyinmana, *Type loc.*, and Toungoo, Myohla (*M. H. Desai*) ; both sexes bred, January, February, May, and September, 1933–1934, from eggs of *Hapalia machæralis* Walker. This material bears the reference number I.R.1666.

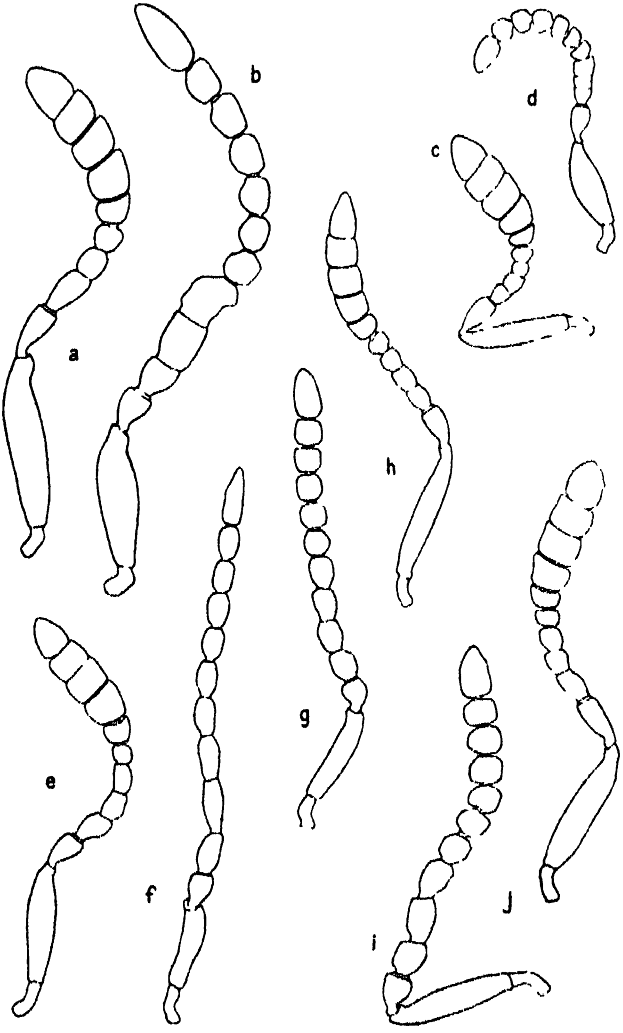
This a distinct little species, characterised by its large, wide head and pale, predominantly yellowish antennæ in both sexes.

Telenomus olynthus, sp. n. (Fig. 1, *b*.)

♂♀. Black. Legs, except front coxæ and apical segment of all tarsi, yellow. Scape in both sexes more or less same colour as the legs ; basal half of ♀ funicle only slightly paler than the apical half ; ♂ funicle dark brown throughout.

♀. *Head* only very slightly wider than the thorax ; for the genus less transverse than usual and lacking a crescentic appearance. Frons entirely smooth and shining everywhere, the supra-antennal impression rather deep. Eyes large, with excessively minute scattered

Fig. 2.



Antenna of (*a*) *Telenomus* (*Aholcus*) *urios*, sp. n., ♀; (*b*) *Telenomus* (*Aholcus*) *urios*, sp. n., ♂; (c) *Telenomus periparetus*, sp. n., ♀; (*d*) *Telenomus periparetus*, sp. n., ♂; (*e*) *Telenomus ochus*, sp. n., ♀; (*f*) *Telenomus ochus*, sp. n., ♂; (*g*) *Telenomus usipetes*, sp. n., ♂; (*h*) *Telenomus usipetes*, sp. n., ♀; (*i*) *Telenomus olynthus*, sp. n., ♂; (*j*) *Telenomus olynthus*, sp. n., ♀. All drawn to the same scale.

hairs, hardly visible at (×60); shortest distance between them, when the head is seen from above, slightly less than their width, about 5 : 6. Vertex not at all angled between the ocelli, being merely feebly rounded; between the temples it appears somewhat scooped out. The ocelli form nearly an equilateral triangle; the surface between them is very shining but has a few ill-defined punctures and some feeble scaly-reticulate sculpture. Antennæ (fig. 2, *j*): club more or less 4-segmented. Postorbital margin rather strongly raised (fig. 1, *a*).

Thorax somewhat flattened. Mesonotum less shining than the sculptured parts of the head, having a close scaly-reticulate sculpture, but becoming more shining posteriorly where it shows indication of ill-defined punctures. Scutellum flattened, smooth. Postscutellum smooth. Legs rather short and thick. Hind wings slightly widened beyond the nervature; fringe at widest part about ¾ the width of the wing there.

Abdomen nearly twice as long as wide. Tergite 1 strongly transverse, its costæ not reaching much beyond the middle and forming a row of deep pits; 2 with a costate furrow at extreme base.

♂. Antennæ (fig. 2, *i*). Genitalia very distinctive (fig. 3, *c*); apical appendages with only two widely separated teeth, and in this respect different from what occurs in any other Asiatic species I have described.

Length, ♂♀, about ·75 mm.

E. SUMATRA: Asahan, 50–60 m. (*F. Schneider*); 4 ♀♀, 1 ♂, bred 1934–36 from eggs of a moth, probably *Pyralidæ*, on *Uncaria Gambir* Roxb. Material has reference number A/1113.

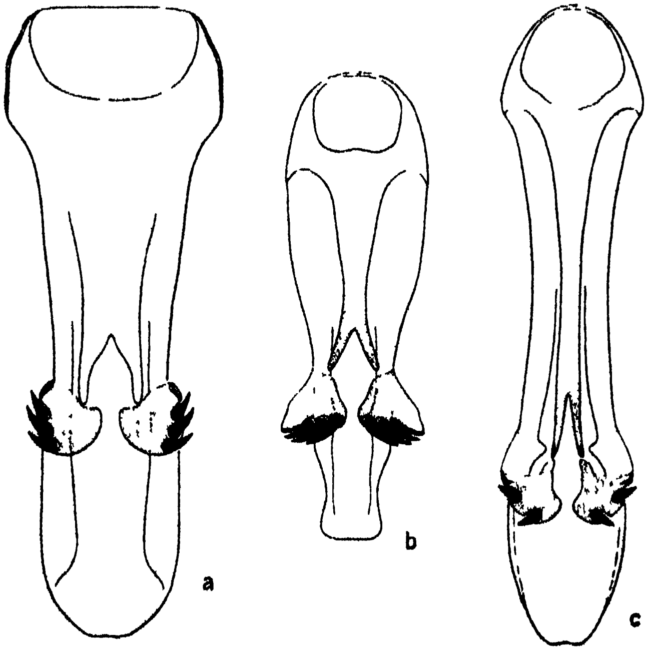
This species appears to be characterised in the ♀ by shape of head, size and closeness of eyes, combined with elongate facies.

Telenomus periparetus, sp. n. (Fig. 1, *f*.)

♂♀. Black. Legs dingy yellow; coxæ darker; apical tarsal segment of all legs not blackened. Scape of ♀ more or less same colour as the legs; first 5 segments of funicle not markedly paler than the rest; ♂ antennæ yellowish throughout.

♀. *Head* only very slightly wider than the thorax, somewhat crescentic, seen from above, being cut away almost at right-angles behind the eyes. Frons with some scattered punctures, especially towards the orbits and the anterior ocellus; otherwise smooth, unsculptured. Vertex between the posterior ocelli fairly evenly rounded, its surface with some very weak sculpture and ill-defined punctures. Antennæ: funicle 5 in colour and size nearer to 4 than to 6, so that the club is more or less 4-segmented (fig. 2, *c*); funicle 1 not at all longer than wide. Eyes apparently bare (× 60).

Fig. 3.



Male genitalia of (*a*) *Telenomus* (*Aholcus*) *urios*, sp. n.; (*b*) *Telenomus ochus*, sp. n.; (*c*) *Telenomus olynthus*, sp. n. All drawn to same scale.

Thorax somewhat flattened. Mesonotum not at all markedly convex, with indication of ill-defined punctures on a very feebly sculptured ground. Scutellum strongly transverse, smooth. Postscutellum defined as a narrow, shining band. Legs rather short and thick (figs. 4, *a*, *b*). Wings as in the preceding species, but stigmalis paler.

Abdomen about twice as long as wide. Tergite 1 strongly transverse, its surface characteristically smooth and unsculptured, the striations being reduced to a row of small pits at basal margin ; 2 finely striate at extreme base, the sculpture not at all readily discernible.

♂. Head not at all wider than the thorax. Eyes a little smaller than in ♀. Antennæ short, the segments closely articulated (fig. 2, *d*) ; funicle 2 irregularly transverse. Legs thicker than in ♀. Genitalia (fig. 4, *e*) ; the drawing was made from four preparations.

Length, ♂♀, ·65 mm.

E. SUMATRA : Asahan, 50–60 m. (*F. Schneider*) ; series containing both sexes, bred 1934–36 from eggs of a Geometrid moth on *Uncaria Gambir* Roxb. Series has reference number B/1035.

This is an elongate species and in general facies resembles *olynthus*. Among the more obvious differences are the more transverse head of *periparetus*, the unraised postorbital margin, and the weaker mesonotal sculpture. Also, the basal segment of the middle tarsus is shorter in *periparetus* than in ♀ *olynthus*. Apart from widely different-looking genitalia, the ♂ of *olynthus* has the funicle dark with the segments less closely articulated than in *periparetus*.

In my key (Ann. & Mag. Nat. Hist. v. 20, p. 444, 1937) these two species run to the group of *dignus* Gahan, but the forms I include in that group are more slender insects with longer legs.

Telenomus ochus, sp. n. (Fig. 1, *c*.)

♂♀. Brownish black. Legs entirely (except the anterior coxæ and apical tarsal segment of all legs, which are darkened), bright yellow. Scape in both sexes slightly darkened towards apex ; basal 5 funicular segments of ♀ not much paler than the rest ; entire funicle in ♂ uniformly brown.

♀. *Head* large for the size of the insect, much wider than the thorax. Frons everywhere smooth, shining, without punctures. Vertex between the ocelli with some vague scaly-reticulation and with indication of feeble punctures ; behind the ocelli it is rather sharply declivous. Shortest distance between the eyes slightly greater than their width as seen from above, about 13 : 11 ; eyes themselves apparently bare (×60). Antennæ long and powerful for the size of the insect; club tapering rather gradually to apex, more or less 4-segmented; funicle 1 and 2 distinctly elongate (fig. 2, *e*).

Thorax not at all flattened. Mesonotum with weak, quite indefinite sculpture, feebly shining. Scutellum not strongly transverse. Postscutellum rugose. Wings: venation very pale and indistinct; hind wings virtually parallel-sided beyond the nervature, their fringe about equal to their greatest width. Legs fairly slender (figs. 4, *c*, *d*).

Abdomen, when segments are not retracted, about 1½ times as long as wide, widest beyond the middle and rather sharply narrowed to base. Tergite 1 less transverse than in *olynthus* and *periparetus* and with strong, even striations over virtually its entire length.

♂. Antennæ characteristically distinct, on account of their slenderness, from any other Asiatic *Telenomus* I have described (fig. 2, *f*); funicle 2, in some aspects, about 3 times as long as wide; 3 not much shorter; 5–9 distinctly elongate and not closely articulated. Genitalia very distinctive on account of the three long, very close teeth on apical appendages (fig. 3, *b*); in the figure I have shown these teeth as slightly separated, but in the two preparations from which the drawing was made they are so closely packed together that a separation between them is not easy to make out.

Length, ♂♀, about ·6 mm.

E. Sumatra: Asahan, 50–60 m. (*F. Schneider*); both sexes bred 1934–36 from eggs of *Oreta carnea* Butl. (Drepanidæ) on *Uncaria Gambir* Roxb. Material has reference number O/1008.

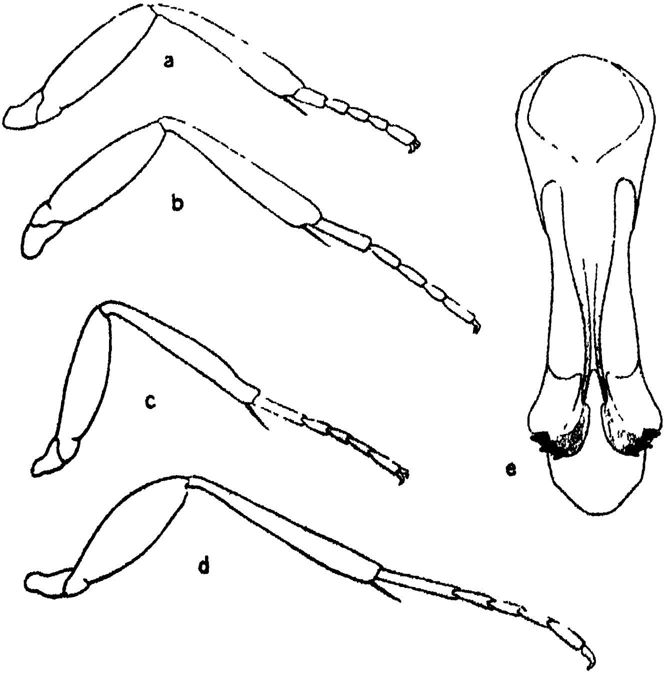
This little species is probably characterised in both sexes by its wide head and structure of antennæ.

Telenomus (*Aholcus*) *urios*, sp. n. (Fig. 2, *a*.)

♂♀. **Black.** Legs obscure yellow with the coxæ darkened. Scape yellow in both sexes; basal segments of ♀ funicle only slightly paler than the rest; 3 basal segments of ♂ funicle yellow, the rest considerably darker.

♀. *Head* not at all sharply cut away behind the eyes, so that these do not appear to occupy the entire lateral surface of the head. Frons shining but nowhere completely smooth, having an extremely weak surface-sculpture which is stronger and describable as scaly-reticulate between the eyes and the antennal insertions and along the inner orbits; there are a few feeble, ill-defined punctures, more especially towards the inner orbits and the anterior ocellus. Vertex between the ocelli with more or less the same sculpture as that along the inner orbits. Shortest distance between the eyes to their width as seen from above, as 9 : 7. Vertex more or less evenly rounded between the posterior ocelli and the occipital margin. Postorbital margin somewhat raised so that the head appears widened behind the eyes. Antennæ (fig. 2, *a*): funicle 1 distinctly longer than

Fig. 4.



(*a*) *Telenomus periparetus*, sp. n., middle leg of ♀; (*b*) *Telenomus periparetus*, sp. n., hind leg of ♀; (*c*) *Telenomus ochus*, sp. n., middle leg of ♀; (*d*) *Telenomus ochus*, sp. n., hind leg of ♀; (*e*) *Telenomus periparetus*, sp. n., genitalia of ♂.

wide; club not clearly differentiated, sub-5-segmented. Eyes with short hairs readily visible at (×60).

Thorax: mesonotum with clear indication of ill-defined punctures (×60), the surface between them scratched. Scutellum smooth. Postscutellum with a medial transverse rugose swelling. Hind wings distinctly widened beyond the nervature; fringe at widest part hardly ⅔ width of wing there.

Abdomen a little more than 1½ times as long as wide, about 5 : 3. Tergite 1 strongly transverse, closely evenly striated all over; 2 with fine striations radiating beyond the basal costate furrow over about quarter the length of the segment.

♂. Antennæ distinctive (fig. 2, *b*); funicle 1 and 2 much dilated; 2 concave on one side; 4–9 spherical. Genitalia (fig. 3, *a*).

Length, ♂♀, about 1 mm.

MALAYA: Prov. Wellesley (*G. H. Corbett*); (Ref. no. 0943), 2 ♂♂, 2 ♀♀, bred 19. v. 1936 from eggs of a Hesperid, *Hidari irava* Mr.

From the seven Asiatic species of *Aholcus* that I have already described, *urios*, in ♀, differs in a combination of the shape of the head and sub-5-segmented antennal club. In the ♂, the antennæ and genitalia are characteristic.

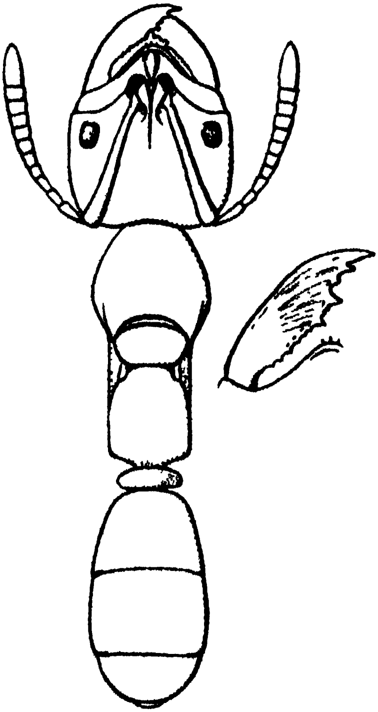
LXVII.—*New Species and Varieties of Ants from New Guinea.* By HORACE DONISTHORPE, F.Z.S., F.R.E.S., etc.

Subfamily PONERINÆ.

Pseudoponera lubbocki, sp. n.

☿. Black, smooth, and shining, legs, antennæ, and mandibles brown, funiculi and tarsi lighter. Whole body clothed with longer and shorter outstanding golden hairs, and with larger and smaller punctures.

Head without mandibles and lobe of clypeus slightly broader than long, slightly narrowed to base, posterior angles rounded, posterior border at occiput forming a declivity which is abrupt, flat, and very finely concentrically striate; *mandibles* neither so long nor so narrow as in *amblyops* Emery, and the curve from the basal border to the masticatory border is still more marked, finely longitudinally striate, with larger and smaller punctures, more distinct towards apex, armed with four teeth, the apical one being the longest, the third is longer than the second, and the fourth is the shortest; a small tooth or denticule occurs between the second and third tooth, and two more between the third and



Dorsal aspect and mandible of *Pseudoponera lubbocki*, sp. n.

fourth, some six small denticules are present after the fourth tooth; *clypeus* projecting into a lobe, rounded at anterior border, with a raised smooth carina in centre, and three small sharp spines on anterior border, the whole clypeus, with the exception of the carina, finely longitudinally striate; *frontal carinæ* with well-marked lobes, strongly narrowed behind; space between insertion of antennæ and eyes finely longitudinally striate; *frontal furrow* deep, extending beyond eyes, the anterior end extending on each side of the clypeal carina; *eyes* situated towards front of head, large, rather flat, with a distinct margin round them; *antennæ*: *scape* with small scattered punctures, just reaching posterior border of head; *funiculus* gradually thickened to apex, last joint tapering to a blunt point, first joint and base of second smooth and shining, the rest pubescent, 1st joint longer than 2nd, 2 and 3 longer than broad, 4 and 5 quadrate, 6–10 transverse, 11 longer than the two preceding taken together. *Thorax* long, narrowed in middle; *pronotum* convex with a distinct neck, which is transversely striate, anterior angles rounded, suture between pronotum and mesonotum double, as in *amblyops*; *mesonotum* small, convex, clearly defined, with a suture all round, that between the epinotum being very distinct, which in *amblyops* is very ill defined and vague; *epinotum* about as long as pronotum, dorsal surface longer than the declivity; the *epimera* and *episternite* of mesothorax are almost separated by an indication of a suture, as in *Ectomyrmex*, which is not so marked in *amblyops*; *scale* of *petiole* slightly concave posteriorly, convex anteriorly, high, with a rather narrow ridge, not so thick as in *amblyops*; *gaster* small, *post-petiole* as long as second segment, slightly broader than long, with a blunt tooth or projection at base beneath. *Legs* rather long, posterior *tarsi* long.

Long. 5·6 mm.

Described from 12 workers taken by Miss L. E. Cheesman on Mount Lina, 3500 ft., Cyclops Mountains, Dutch New Guinea, March 1936.

Type in Brit. Mus. Coll.

Named in honour of Sir John Lubbock (1st Lord Avebury).

This species differs from *amblyops* in colour, the size of the eyes, which in that species are very small, construction of the jaws, smoothness of integument, and many other points. It also does not agree with Emery's description of the genus *Pseudoponera* in various ways. I have, however, thought it best not to create a new genus on one specimen, especially also as Forel, when describing *P. butteli*, stated that he thought he was not making a mistake when he attributed that species to the genus *Pseudoponera*. It is also smooth and shining and has large eyes. It differs from *lubbocki* in size (being considerably smaller), in colour, construction of the jaws, etc. Santschi's *P. chelifer* is also smooth and shining, and has the eyes two or three times as large as in *amblyops*. From *lubbocki* it differs in colour, size (being larger), construction of the jaws and joints of the antennæ, breadth of post-petiole, etc.

At present only four species are known, as follows :—

P. amblyops Emery (1887). Testaceous; dull and pubescent. Long. 6·5–7·5 mm. Sumatra.

P. butteli Forel (1913). Brownish red-yellow ; smooth and shining. Long. 3·9–4 mm. Java.

P. chelifer Santschi (1928). Bright chestnut-brown ; smooth and shining. Long. 6–6·3 mm. Queensland.

P. lubbocki, sp. n. (1938). Black ; smooth and shining. Long. 5·6 mm. Dutch New Guinea.

Bingham gives the distribution of *P. amblyops* Emery as Sikkim ; Assam ; through Burma and Tenasserim to the Malay Peninsula. His figure is not good, the meso-epinotal suture is far too distinct, and the lobe of the clypeus is rounded instead of being square, a character mentioned by himself in his definition of the genus.

Trapeziopelta castaneicola, sp. n.

☿. Dark castaneous, smooth, shining, mandibles, apex of scape, funiculus, last segment of gaster, and legs, lighter, whole body furnished with extremely fine scattered punctures from which hairs arise.

Head without mandibles, about as long as broad, and of about equal breadth anteriorly and posteriorly, posterior angles rounded, posterior border emarginate ; *mandibles* long, external border rounded, apical tooth longer than another tooth a little distance from it ; two other teeth occur on the masticatory border, of which the first is the longer, and is separated from the second by about the same distance as it is separated from the second apical one; *clypeus* with a short triangular projection, furnished at each anterior corner with a distinct outstanding tooth; *frontal furrow* short and deep; *eyes* small, situated well in front on the sides of the head; *antennæ*: scape not reaching posterior angles of the head, *funiculus* with joints 2–7 transverse, the next four forming a distinct club, of which the last joint is as long as the two preceding taken together. *Thorax* narrowed in the middle, the pro-mesonotal and meso-epinotal *sutures* distinct, the latter being deeper and with a row of short longitudinal ridges in it; *epinotum* convex, with transverse striæ on sides at base, declivity shorter than dorsal surface; *node* of *petiole* high, narrower in front than behind, anterior and posterior surfaces flat, two small teeth occur at the anterior ventral angle, and a larger tooth, projecting forward beneath, at the junction with the gaster.

Long. 5·2 mm.

Type in Brit. Mus. Coll.

Described from two workers taken by Miss L. E. Cheesman at Kokoda, 1200 ft., Papua, October 1933.

This species somes nearest to *T. bidens* Emery, from Sumatra, from which it differs in colour and in punctuation, etc. The *T. mayri* Donis. (1932) [*Ponera nitida* Smith (1861), nec *P. nitida* Smith (1858)] from Celebes, is slightly larger, considerably lighter in colour, and with longer hairs, etc.

Anochetus cato Forel var. *variegatus*, var. nov.

☿. Head, antennæ, tibiæ, and tarsi reddish yellow, a small part in centre of front of head darker, mandibles, scale, end of gaster, femora, and coxæ yellow. *Thorax* lighter or darker brown, gaster varying from lighter or darker brown to jet-black.

Long. 5–5·25 mm.

Similar to the typical form in size, structure, and sculpture, but darker and more variegated in colour. It varies from the var. *subfasciatus* Mann, from the Solomon Islands, in colour, the latter being almost black.

Type in Brit. Mus. Coll.

Described from four ☿☿ taken by Miss L. E. Cheesman on Mount Nemo, south of Mount Bougainville, 600–1500 ft. Dutch New Guinea, February 1936.

Subfamily *Dolichoderinæ*.

Bothriomyrmex pallidus, sp. n.

☿. All pale yellow, shining, eyes black, margins of the mandibles reddish brown. Whole body covered with a fine pale yellow pubescence, more noticable on the head; a few small longer and shorter outstanding hairs, chiefly on the clypeus and gaster.

Head slightly longer than broad, slightly narrower in front, with rounded posterior angles, posterior border slightly widely emarginate, slightly excavate along the *frontal furrow*; *mandibles* punctate, armed with two teeth at the apex, the apical one being the longer, and two other shorter teeth in centre of masticatory margin; *clypeus* convex, anterior border slightly rounded; maxillary and labial palpi two-jointed; *antennæ*: *scape* not reaching posterior angles of head, *funiculus* with joints 2–10 transverse, gradually increasing in breadth, last joint tapering to apex, equal in length to the three preceding together; *eyes* very small, consisting of about four or five facets. *Thorax* with pro-mesonotal and meso-epinotal sutures equally fine and distinct; scale small; *gaster* rather long.

Long. 2 mm.

Type in Brit. Mus. Coll.

Described from a worker taken by Miss L. E. Cheesman on Mount Lina, 3500 ft., Cyclops Mountains, Dutch New Guinea, March 1936.

This species, the first record of the genus for New Guinea, is very like *flavus* Crawley, from West Australia, in general appearenace. It is, however, a little smaller, and the construction of the mandibles and antennæ is quite different. The eyes are also smaller.

Subfamily *Formicinæ*.

Œcophylla smaragdina F. subsp. *subnitida* Emery var. *krampsi*, var. nov.

☿. This variety differs from the subspecies in being a little darker in colour, slightly less shining, the very fine pubescence slightly more pronounced, and the pedicel very slightly longer and narrower.

Described from a number of examples taken by Miss L. E. Cheesman in Dutch New Guinea at Mount Nemo, 600–

1500 ft., in February, Hollandia, Humboldt Bay, in April, and Cyclops Mountains, Labron, in June 1936.

Type in Brit. Mus. Coll.

♀. Dark brown with a slight greenish or purplish tinge; mandibles: last four joints of funiculus and apex of other joints, parapasidal furrow, coxæ, and tarsi yellow. Rather shining, covered with a fine grey pubescence, and with short outstanding yellow hairs. The ♀ of *subnitida* has not been described, but this ♀ differs from that of typical *smaragdina* in its much darker colour and more shining surface. The pubescence is more distinct, and the punctures on the mandibles are larger and deeper.

Long., ☿ 7·2 mm., ♀ 19 mm.

Described from a deälated female taken by Miss L. E. Cheesman on low herbage in Dutch New Guinea, Cyclops Mountains, Labron, 930 ft., in May 1936.

This variety is named after the Dutch Controller of Hollandia.

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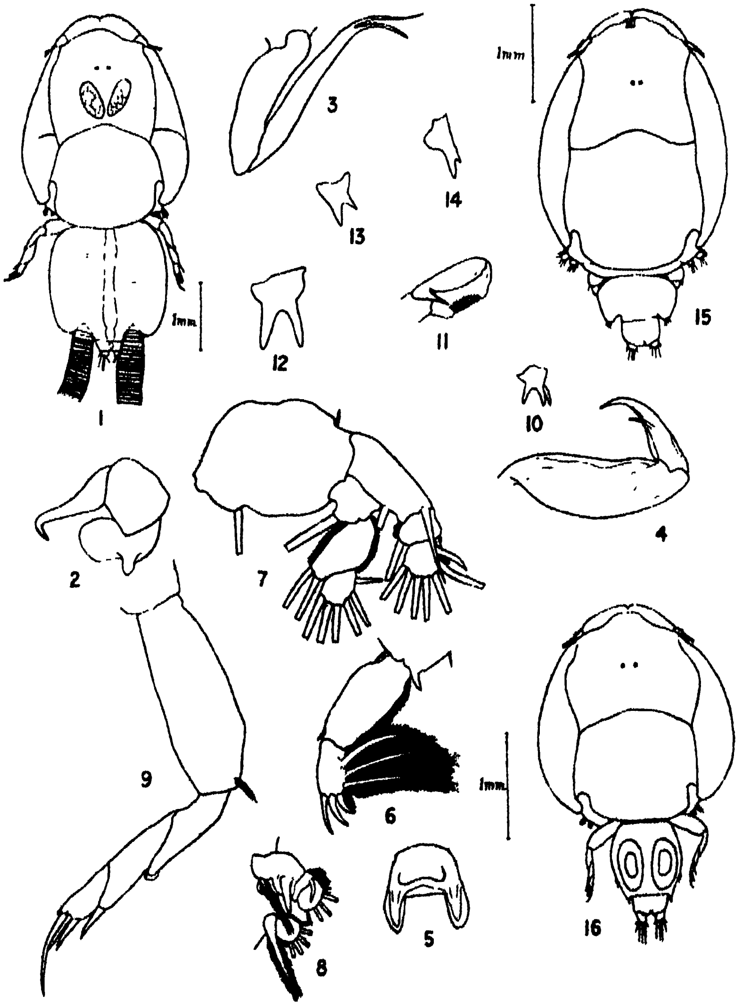
LXVIII.—*A new Species of the Genus* Lepeophtheirus *from the North Pacific.*

By LAWRENCE D. TOWNSEND, Washington State Department of Fisheries, Seattle, Washington.

AN accumulation of parasitic copepod material, as the result of several years' work collecting fish along the Pacific coast of North America, has yielded a number of specimens referred to the genus *Lepeophtheirus* but assignable to no known species. The copepod is found on the Pacific codfish, *Gadus macrocephalus*, and on the starry flounder, *Platichthys stellatus*.

Lepeophtheirus septentrionalis, sp. n.

Female.—Carapace ·8 as wide as long, its length ·6 of the total length exclusive of the egg-strings.



Lepeophtheirus septentrionalis, sp. n.

Fig. 1.—Female, dorsal.
Fig. 2.—Female, second antenna.
Fig. 3.—Female, first maxilliped.
Fig. 4.—Female, second maxilliped.
Fig. 5.—Female, furca.
Figs. 6–9.—Female, first to fourth legs. (Plumose setæ of the second and third legs not shown for entire length.)
Fig. 10.—Male, second maxilla.

Greatest width of carapace at the posterior third. Lateral lobes round in posterior and rather narrow. Posterior lobe two-thirds greatest width of carapace. Posterior sinuses deep and narrow. First antennæ inconspicuous on the outline. Dorsal grooves not well formed. Fourth legs extend over half length of the genital segment. Free thoracic segment is very short and entirely overlapped by the posterior margin of the carapace. Genital segment nearly as wide as long, the width being more than that of the posterior lobe of the carapace. The sides are evenly rounded and curve shortly at the hind corners to form a truncate posterior margin, which is interrupted by the abdomen and the attachment of the egg-strings. The abdomen is not quite as long as wide and is only slightly wider than the egg-strings. The eyes are small and quite inconspicuous.

The general proportions of the appendages are similar to those found typically in the genus. The first antenna is small, with the basal segment armed with many hairs; terminal joint four times as long as wide, with about seven long spines. Second antenna with a strong curved hook which is about one-fourth of the entire length. First maxilla long, uniramous, curving slightly mediad. Second maxilla variable, but in mature specimens with two branches equal, diverging, with the space between them rounded. First maxillipeds with the terminal joint twice the basal, the posterior branch of which is three-fourths the length of the anterior. This branch has a flattened blade that is delicately pectinate. Second maxilliped basal joint enlarged, longer than terminal, which is slightly curved to a point and is provided with a long spine on the inner surface.

First swimming-legs with terminal claws graded slightly shorter posteriorly. Two posterior claws with very fine teeth on the inside. Second leg of usual form,

Fig. 11.—Male, second antenna.
Fig. 12.—Female, mature, second maxilla.
Figs. 13, 14.—Female, immature, second maxillæ.
Fig. 15.—Female, immature, dorsal.
Fig. 16.—Male, dorsal.

Appendages all × 32. (All figures drawn with the aid of a camera lucida.)

with rami of equal length. Third legs small, rami close together, exopod spine stout and blunt.

Fourth legs characteristic of the species, and taken with the furca form a ready means of separation from other members of the genus. First joint half the length of leg, second and third joints equal, the latter stouter. Terminal joint one-half third, with three spines, the outer of which is 2·2 times the length of the inner two, which are the same length. The third joint has a distal spine the same length as the short spines of the terminal joint. Distal spine of second joint is very small, claw-shaped, and supported by a fan-like plate. First joint with a small distal plumose seta. The spines have been carefully checked in a number of specimens and are found to have very little variation among the individuals, particularly so the spines of the terminal joint, the relative lengths of which are remarkably constant. Because of the use to which the fourth legs are put in copulation it is suggested that the characters of this appendage should justify greater reliance upon it for use in the taxonomy of the genus *Lepeophtheirus*.

The furca is longer than wide, with the base longer than the branches, which have a slight flare and are widely separated by a space that is square and straight-sided.

Anal laminæ are short, separated by half the width of their bases, each with three terminal plumose setæ, lateral to which are two simple setæ and mediad to which is another simple seta.

The eggs are ·31 to ·40 mm. in diameter and ·06 to ·07 mm. in thickness. Females were found with from few to over 90 eggs in each string.

Male.—The male was found free and in copulation with mature and immature females. Carapace nearly as wide as long. Fourth legs prominent, reaching past end of genital segment. Fifth and sixth leg rudiments visible from the dorsal side. Swimming appendages little different from female. Second antenna with very strongly curved terminal claw, the tip of which appears to press down upon the basal joint, which is provided for a part of its length with a series of sharply raised fine ridges, about eighteen in number. Copulating females are so firmly held that these appendages are broken off from the male in attempting to separate the copulants. The second maxilla has the inner ramus divided.

Immature.—A number of immatures have been obtained. The carapace is longer than wide and more nearly ovoid than in the adults. It is covered with fine interlacing marks in addition to the grooves figured. The fourth legs are short, but the sixth legs are prominent, being definite papillæ raised on protruding lobes of the genital segment. The furca appears to be relatively smaller than in the adult female and the space between the branches is somewhat rounded. The most obvious difference, and one that varies with the stage of development, is in the size of the inner ramus of the second maxilla, which develops rapidly in size with age. Figs. 13 and 14 show this appendage in immature specimens that were taken *in copulo*. These sketches should be compared with fig. 12, the second maxilla of a female bearing egg-strings.

Occurrence.—Found on the head and dorsal surfaces and under the pectoral fins of *Gadus macrocephalus* and on the eyed side of *Platichthys stellatus*. The codfish were from collections made at Larsen Bay, Kodiak Island, Alaska and Hook Bay, Alaska. A number of specimens were found on each of nine cod examined, as follows:—

Cod fish no.	Adult free females.	Adult free males.	Pairs in copulation.	Immatures free.
1	11	5	1	4
2	35	31	6	1
3	7	3	1	0
4	27	8	1	1
5	13	4	0	0
6	13	2	3	2
7	13	6	0	0
8	28	7	1	4
9	9	5	0	0

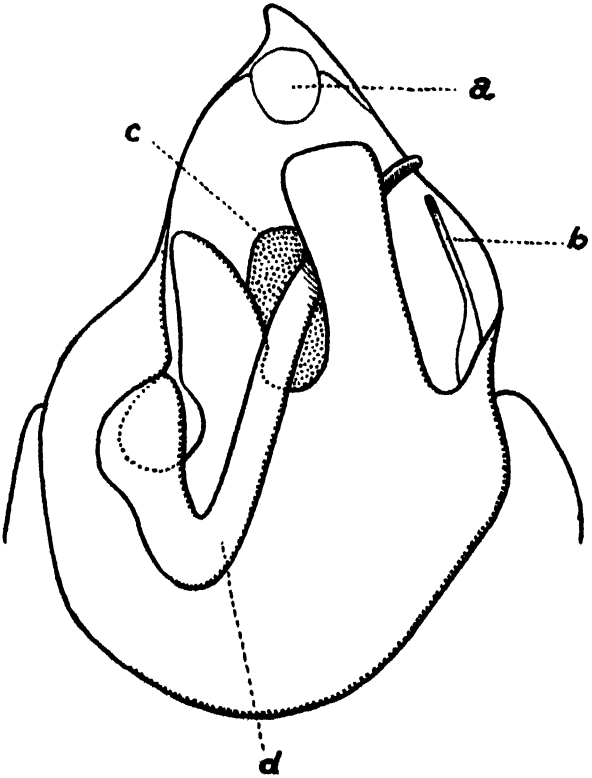
A specimen of *Platichthys* taken at Friday Harbour, Washington, yielded two females of this species. A female from codfish no. 2 has been designated the type and remains for the present in the author's collection. The specimens from codfish no. 4 have been deposited in the United States National Museum, where they bear the no. 75750. Mounted male and female paratypes have been deposited in the British Museum.

The mature specimens bore a large variety of parasitic or commensal species attached to the exoskeleton, among which were trematodes of the family Udonellidæ, hydroids, stalked protozoa, several species of diatoms and algæ, and clusters of trematode eggs.

LXIX.—*Synonymy of* Engytatus tenuis *Reut.* (*Tobacco Capsid*). By W. E. CHINA, M.A., Department of Entomology, British Museum (Natural History).

IN 1903 Koningsberger described and figured under the name *Leptoterna nicotianæ* a Capsid damaging tobacco plants in Java. In 1919 den Doop recorded specimens of this species from Sumatra under the name *Gallobelicus nicotianæ* Koningsb. Horváth, in 1922, gave a redescription of the same insect, on the basis of Sumatran specimens sent to him by Fulmek, under the name *Dicyphus nicotianæ* Koningsb., but in 1926, having received better preserved material from Fulmek, he revised his identification, and decided that the insect was really identical with *Engytatus tenuis* Reut. Fulmek, however, had also submitted some material to Bergroth, who determined it as a new species, *Dicyphus nocivus*, but did not describe it. Fulmek meanwhile had obtained some specimens of a tobacco Capsid from Java which he took for the real *nicotianæ* of Koningsb., and found that it differed from the Sumatran species (*nicotianæ* den Doop & Horv.) in the structure of the male genitalia without otherwise being distinguishable in any way. He therefore described the Sumatran species, using Bergroth's manuscript name *nocivus*, thereby unwittingly forestalling Bergroth as the author of the species. The only character by which he differentiated the Javan species from the Sumatran was the structure of the left paramere in the male. A glance at his figure at once demonstrates that he is not comparing the same organ in the two species. Judging by the shape of the " Haftzange " in *nicotianæ* it appears to be a broken portion of the inferior lateral margin of the pygophor (ninth abdominal segment) viewed from the left side of the pygophor but with the drawing actually reversed. In the case of *nocivus* he figured the actual paramere, calling it again the "linke Haftzange."

The accompanying figure of the male genitalia of a co-type, *Engytatus tenuis* Reut., will show that the two structures are parts of the same genital armature. Fulmek's figures are very crude and apparently scarcely accurate. In any case there is a certain amount of variation in these structures even among specimens from the same colony. There is no doubt that Horváth, who actually saw some of Fulmek's material, was correct in identifying *nicotianæ* with *Engytatus tenuis* Reut., with which he was also perfectly familiar.



Engytatus tenuis Reut. ♂ genitalia, ventral view.
a, anal tube; *b*, right paramere; *c*, ædeagus; *d*, left paramere.
Note two tongue-like processes from inferior margin of pygophor.

There has been considerable confusion over the genera *Dicyphus*, *Engytatus*, and *Cyrtopeltis*, and it is not out of place here to clarify the situation. The genus *Cyrtopeltis* was established by Fieber in 1860 (Europ. Hem. pp. 76 & 323) for a single Mediterranean species, *C. geniculata* Fieb.

In 1876 Reuter (Öfv. K. Vet.-Akad. Förhandl. xxxii. 1875, no. 9, p. 82) established the genus *Engytatus* for a single N. American species, *E. geniculatus* Reut., closely allied to *Dicyphus*.

In 1895 Reuter (Rev. d'Ent. xiv. p. 139) described a new species of *Cyrtopeltis* from Madeira under the name *C. tenuis*.

In 1909 Reuter (Act. Soc. Sci. Fenn. xxxvi. no. 2, p. 62) synonymized *Engytatus* with *Cyrtopeltis*, and described two additional N. American species. He pointed out that the Mediterranean *Cyrtopeltis tenuis* Reut. was closer to the American species than to the genotype, *C. geniculatus* Fieb. He also showed that since *Neoproba varians* Dist. was, as had been pointed out by Uhler (Trans. Zool. Soc. 1894, p. 193), a synonym of *Engytatus geniculatus* Reuter, Distant's name *varians* would replace *geniculatus* Reut., preoccupied in *Cyrtopeltis* by Fieber's genotype.

In 1910 Reuter (Act. Soc. Sci. Fenn. xxxvii. no. 1, p. 151, footnote) changed his mind, and came to the conclusion that *Engytatus* was distinct from *Cyrtopeltis* and that the Mediterranean *Cyrtopeltis tenuis* Reut. should be transferred to *Engytatus*, thus leaving *Cyrtopeltis* with a single European species, *C. geniculatus* Fieb. At the same time he erroneously synonymized *Gallobelicus* Dist. (Faun. Brit. India, Rhyn. ii. p. 477, 1904) with *Cyrtopeltis* instead of with *Engytatus*, apparently on the authority of Poppius.

In 1913 Poppius (Tijdschr. v. Ent., Suppl. lvi. pp. 163–4) described two new species of *Cyrtopeltis* from Java. Of these *C. javanus* he placed very near *Cyrtopeltis* (i.e., *Gallobelicus*) *crassicornis* Dist.

In 1915 Poppius (Archiv. f. Naturgesch. 1914, lxxx. A, no. 8, p. 60, footnote) transferred *Cyrtopeltis crassicornis* Dist. to the genus *Dicyphus*, and placed *Gallobelicus* Dist. as a synonym of *Dicyphus* Fieb. (Wien. Ent. Monat. 1858, p. 327). At the same time he described two new Formosan species of *Engytatus*.

In 1922 Horváth ('Konowia,' i. no. 4–5, p. 176), although he had on a previous page referred Koningsberger's *Leptoterna nicotianæ* to the genus *Dicyphus*, deliberately stated that *Gallobelicus crassicornis* Dist. was not a *Dicyphus*, but either a *Cyrtopeltis* or an *Engytatus*, and even went so far as to suggest that *G. crassicornis* Dist. was identical with the widely distributed *Engytatus tenuis* Reut.

In 1926 Horváth ('Treubia,' viii. no. 3–4, p. 332) confirmed his previous suggestion, and gave a complete synonymy of *Engytatus tenuis* Reuter. To this may now be added *Dicyphus nocivus* Fulmek and *Cyrtopeltis javanus* Poppius, the description of which in no way differs from *Gallobelicus crassicornis* Dist.

The full synonymy of this important tobacco species now runs as follows:—

Engytatus tenuis Reut.

1895. *Cyrtopeltis tenuis* Reut., Rev. d'Ent. xiv. p. 139.
1903. *Leptoterna nicotianæ* Koningsb., Mededeel's Lands Plantent. lxiv. p. 32, tal. 4, fig. 8.
1904. *Gallobelicus crassicornis* Dist., Faun. Brit. India, Rhyn. ii. p. 477.
1910. *Engytatus tenuis* Reut., Act. Soc. Sci. Fenn. xxxvii. no. 1, p. 151 (footnote).
1913. *Cyrtopeltis javanus* Popp., Tijdschr. v. Ent., Suppl. lvi. p. 163, syn. nov.:
Cyrtopeltis crassicornis Popp., *loc. cit.*
1915. *Dicyphus crassicornis* Popp., Archiv f. Naturges. 1914, lxxx. A, no. 8, p. 60 (footnote).
1919. *Gallobelicus nicotianæ* den Doop, Bull. Van Het Deli-Proefstat. xii. p. 1.
1922. *Dicyphus nicotianæ* Horv., 'Konowia,' i. p. 174, fig. 1.
1925. *Dicyphus nicotianae* Fulmek, Bull. Van Het Deli-Proefstat. no. 25, p. 2.
Dicyphus nocivus Fulmek, *loc. cit.* p. 4.
1926. *Engytatus tenuis* Horv., 'Treubia,' viii. no. 3–4, p. 332.

LXX.—*The Fauna of the Weevil "Sack-band."*—III.

By A. M. Massee, D.Sc., and R. M. Greenslade, B.Sc.
(East Malling Research Station.)

The second paper, entitled "The Fauna of the Weevil 'Sack-band.'—II.," was published in this Magazine in September 1935, bringing the number of species of insects recorded in the bands up to one hundred and sixty (1, 2).

One hundred additional species have been noted in the years 1935, 1936, and 1937, making a total of two hundred and sixty altogether. Since some of these species are of interest, it is proposed to record the recent additions.

As in former years, more species of Coleoptera and Hemiptera have been noted than of other orders, and it is somewhat surprising that so few larvæ of Lepidoptera find their way into the bands.

Although the Apple-blossom Weevil (*Anthonomus pomorum* (L.) Curt.) is the predominating species found in the bands, it is of interest to record the Codling Moth (*Cydia pomonella* L.) in large numbers, and also the Clay-coloured Weevil (*Otiorrhynchus singularis* L.), another harmful insect.

Some uncommon species of Hemiptera sometimes shelter in the bands, for example, *Calyptonotus rolandri* L., *Aphanus alboacuminatus* Goeze, *Aradus depressus* F., *A. aterrimus* Fieb., and *Ploiariola culiciformis* De G. The Homopteron *Ledra aurita* L. is also an occasional visitor.

It will be noted that several species of Coleoptera usually associated with granaries and warehouses are recorded in the bands. This may be accounted for by the fact that a large number of poultry had the "run" of the orchard, and that these insects were introduced with the chicken-food.

It is also difficult to explain why the grasshopper (*Pholidoptera griseoaptera* De Geer) should occasionally occur in the bands. The apple-bark under the bands frequently becomes quite soft, and it is just possible that the grasshopper chooses such a position for depositing its eggs.

Speyer (3, 4, 5, 6, 7, 8) has also made a study of the insects hibernating in fruit-tree trap-bands in the Lower Elbe districts of Germany, and an interesting list of species has been obtained. A comparison of the species recorded from this country and from Germany shows that the fauna of both is very similar, and, but for the fact that Speyer includes a few species of beetles which are not found in Great Britain, the lists are almost identical.

Lundblad (9) also has published a comprehensive list of the insects noted in fruit-tree trap-bands in different parts of Sweden, and it is significant that the majority of the Coleoptera and Lepidoptera are the same species as those found in England.

Certain injurious insects associated with fruit-trees would naturally be found in each of the three countries, but it is somewhat surprising to find so many species of Hemiptera and Coleoptera unconnected with fruit recorded in the bands from England, Germany, and Sweden respectively.

List of Species.

DERMAPTERA.

Forficulidæ.—*Forficula auricularia* var. *forcipata* Stephens.

ORTHOPTERA.

Tettigoniidæ.—*Pholidoptera griseoaptera* De Geer.

HEMIPTERA—HETEROPTERA.

Pentatomidæ.—*Podops inuncta* F.

Lygæidæ.—*Stygnocoris fuligineus* Geoffr., *Peritrechus geniculatus* Hhn., *P. sylvestris* F., *Trapezonotus dispar* Stål, *Calyptonotus rolandri* L., *Aphanus alboacuminatus* Goeze, *Drymus sylvaticus* F., *Scolopostethus affinis* Schill., *S. decoratus* Hhn., *S. thompsoni* Rout., *Taphropeltus contractus* H.-S.

Tingitidæ.— *Monanthia ciliata* Fieb., *M. cardui* L.

Aradidæ.—*Aradus depressus* F., *A. aterrimus* Fieb.

Reduviidæ.—*Ploiariola culiciformis* De G.

Anthocoridæ.—*Anthocoris gallarum-ulmi* De G., *Lyctocoris campestris* F.

Capsidæ.—*Lygus pastinacæ* Fall.

HEMIPTERA—HOMOPTERA.

Cercopidæ.—*Philænus spumarius* L.

Ledridæ.—*Ledra aurita* L.

LEPIDOPTERA.

Arctiadæ.—*Tyria jacobaeæ* L.

Geometridæ.—*Euchloris vernaria* Hubn.

Drepanidæ.—*Cilix glaucata* Scop.

Lasiocampidæ.—*Eriogaster populi* L.

COLEOPTERA.

Carabidæ.—*Carabus catenulatus* Sp., *C. nemoralis* Ml., *C. violaceus* L., *Notiophilus biguttatus* F., *Leistus spinibarbis* F., *Loricera pilicornis* F., *Pterostichus madidus* F., *Agonum dorsalis* Pp., *Bembidion lampros* Hb., *Dromius nigriventris* Th.

Hydrophilidæ.—*Helophorus rugosus* Ol.

Staphylinidæ.—*Atheta pagana* Er., *A. nigripes* Th., *Conosomus testaceus* F., *Staphilinus globulifer* Fc., *S. compressus* Mm., *Xantholinus longiventris* H., *Oxytelus sculpturatus* Gr., *Omalium cæsum* Gr.

Orthoperidæ.—*Sericoderus lateralis* Gy.

Coccinellidæ.—*Micraspis 16-punctata* L., *Platynaspis luteorubra* Gz.

Endomychidæ.—*Sphærosoma piliferum* Ml.

Erotylidæ.—*Triplax lacordairei* Cr.

Nitidulidæ.—*Epuræa unicolor* Ol.

Trogositidæ.—*Tenebroides mauritanicus* L.

Lathridiidæ.—*Enicmus minutus* L., *E. transversus* Ol., *Corticaria pubescens* Gy., *Corticarina gibbosa* Hb.

Cucujidæ.—*Oryzæphilus surinamensis* L.
Cryptophagidæ.—*Cryptophagus lycoperdi* Sp., *C. badius* St., *C. dentatus* Hb., *Atomaria fuscata* Sr.
Mycetophagidæ.—*Typhæa stercorea* L., *Mycetophagus 4-pustulatus* L., *M. 4-guttatus* Ml.
Scarabæidæ.—*Aphodius prodromus* Bm.
Elateridæ.—*Agriotes sputator* L., *A. lineatus* L.
Dascillidæ.—*Cyphon variabilis* Tb.
Lampyridæ.—*Lampyris noctiluca* L.
Tenebrionidæ. *Tribolium castaneum* Hb., *Palorus subdepressus* Wo.
Curculionidæ.—*Strophosomus melanogrammus* Fo., *Orchestes quercus* L., *Ceuthorhynchus pleurostigma* Mm., *C. floralis* Pk., *Calandra oryzæ* L.

HYMENOPTERA.

Ephialtes crassiseta Thomas. (Parasite of *Cydia pomonella* L. larva.

DIPTERA.

Arrhinomyia tragica Mg. (Parasite of *C. pomonella* L. larva.)

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LXXI.—*A Revision of the Genus* Pterygophorus *Klug*, sensu lato, *with the Description of Two new Genera (Hymenoptera, Symphyta)*. By Robert B. Benson, M.A., Department of Entomology, British Museum (Natural History).

In making this study I have had the advantage of being able to examine material from various Australian museums and to compare their material with that in the British Museum. I therefore wish to thank the Directors of the following museums:—Brisbane (H. A. Longman), Sydney (Dr. Anderson), Canberra (A. L. Tonnoir), Adelaide (H. M. Hale), Melbourne (D. J. Mahony), and Perth (L. Glauert); I also have to thank Mr. P. H. Buck, Director of the Bernice P. Bishop Museum, Honolulu, Hawaii, for the loan of further Australian material.

Morice (1919, pp. 290–293) published a key in which he separated twelve species of *Pterygophorus*, but he mentioned that he considered *P. distinctus* Rohwer, *P. insignis* W. F. Kirby, and *P. zonalis* Rohwer were probably not really specifically distinct from *P. cinctus* Klug. Forsius (1927, p. 287) has already endorsed this view. As, however, there are some striking structural differences between these colour-forms they must be regarded as distinct. Nay, more, as will be seen below I have found it necessary to separate a further new species closely allied to *P. cinctus* Klug, and to separate *P. zonalis* Rohwer into a separate new genus. *P. cinctus* Klug and *P. interruptus* Klug include such a wide range of forms that they are spoken of, in the key, as complexes; further study may reveal that each consists of a species group. In addition to this there were two specimens of *P. opimus* Konow in the collection of the National Museum of Victoria; this species and also *P. biroi* Mocsáry were omitted without explanation from Morice's key. *P. biroi* Mocsáry (1909, p. 9), from New Guinea, I have again had to omit, as I have not been able to understand from the description where in the key it should go, or if, indeed, it is really a true *Pterygophorus*. The species recorded by Morice as *P. bifasciatus* Brullé is unlikely to be that species, and is described at the end of this paper in a new genus and subfamily. This can be separated from the Pterygophorinæ by the very large cenchri, almost meeting in the middle, and the presence of preapical spines to the middle and hind tibiæ as in the Perginæ.

Unfortunately this increased number of forms noticed in sample collections of comparatively few individuals suggest that if these insects were collected in greater numbers it would be found that many more species existed.

It is highly probable that the number will be more than doubled again, as several collectors have already testified to the abundance of individuals of *Pterygophorus*. In New South Wales and Queensland there have at times been serious losses of cattle by death through feeding on the larvæ! Froggatt (1918, p. 671) and Roberts (1932) both record *P. analis* Costa in this connection.

Froggatt (1890) records larvæ of *P. cinctus* Klug, *P. interruptus* Klug, and other species as feeding on *Leptospermum*. In 1901 (p. 7 and fig. 3) he describes and figures a solitary and night-feeding larva of one of the "*cinctus*" group, and he says this is "one of the commonest species about Sydney, where in early summer the perfect insects can be captured on the angophora flowers or the tall flower-stalk of the tea-tree."

Roberts (1932), in a detailed account of the larva of what he calls *Pterygophorus analis* Costa, records the larvæ as feeding by day on various *Eucalyptus* spp. but preferring *E. melanophloia* F. u. M.; he states that when the leaves of this tree are stripped the larvæ attack any plant near by, but that he did not believe eggs were layed in the other *Eucalyptus* spp. themselves except perhaps *E. siderophloia* and *E. crebra*. The larvæ, he says, are social when young, but that though they become solitary when they grow larger, yet the cocoons are sometimes massed together into a conglomerate in the soil. He also mentions that the larvæ had been found feeding on ironwood (*Acacia excelsa*) and apple (*Angophora intermedia*). It is possible that he was dealing with more than one species of *Pterygophorus*.

Mrs. Radford (Miss Hughes) collected larvæ of what I call *P. analis* Costa on *Rumex* sp. in South Australia. *Rumex* is not native to Australia, and the wide distribution of this sawfly is perhaps connected with its adapting itself to feed on such agricultural weeds. She tells me, however, in a letter dated 22. i. 33, that the larvæ also feed on the native *Emex australis*.

Mr. R. E. Turner tells me that he caught *P. leachi* W. F. Kirby mostly on a species of *Eucalyptus*, which is probably its food-plant, while *P. uniformis* W. F. Kirby feeds on a creeper in the jungle.

The genera of the Pterygophorinæ * can be separated as follows :—

A. Eyes clearly converging in front (so that the length of the eye is at least subequal with the distance between the eyes in front in both ♂ and ♀, fig. 1); labium in length about 1½ times the breadth of the clypeus; clypeus small, so that its breadth is at most ⅔ the length of an eye; accessory furrow of pronotum subparallel with side-margin of pronotum (fig. 5); membrane between terga 6 and 7 abnormally exposed and

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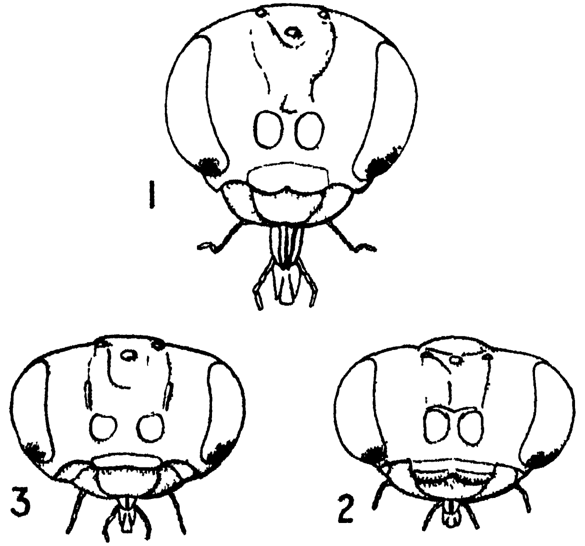
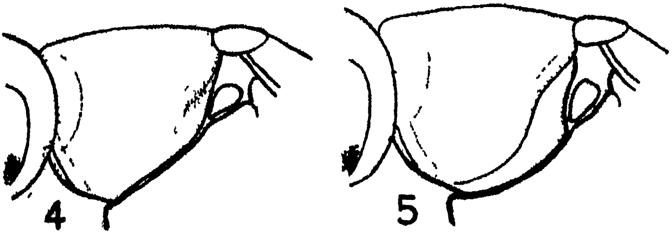
* The relationship between this subfamily and the Perginæ will be dealt with in a forthcoming paper on the classification of sawflies.



Face of (1) *Pterygophorus cinctus* Klug, (2) *Platypsectra analis* (Costa), and (3) *Pteryperga galla*, sp. n.



Side view of the pronotum in (4) *Pteryperga galla*, sp. n., and (5) *Pterygophorus cinctus* Klug.

often bulging between terga; ♂ hypopygium turned up apically almost into an erect position .... Genotype = *P. cinctus* [Klug. *Pterygophorus* Klug.

B. Eyes parallel or very slightly converging in front (so that in the ♀ the length of the eye is at most about ⅔ as long as the shortest distance between the eyes in front and up to ½ in the ♂, fig. 2); labium at most about as long as the breadth of the clypeus; clypeus about as broad as the length of an eye; accessory furrow of pronotum either subparallel with side-margin of pronotum (fig. 5) or else converging strongly till almost meeting the side-margin towards the front, but may be obsolete; membrane between terga 6 and 7 not generally exposed, and except in *P. zonalis* Rohwer ♂ hypopygium normal in position .... Genotype = *Pterygo-* [*phorus analis* O. Costa. *Platypsectra*, gen. nov.

Pterygophorus Klug.

Key to Species.

1. Hind basitarsus in front 1½ times as long as the next tarsal segment; side portion of the pronotum cut off by the accessory furrow at its greatest breadth about ½ length of malar space; abdomen black, without yellow bands on segments 3 and 7.
[Species with long malar space, about as long as the middle of the clypeus, and short antennæ, about ½ length of fore wing; the basal six segments of the flagellum are pale, and, as in *P. cinctus* Klug, in the ♀ the segments are very little produced, while in the ♂ the basal segments have long projections. (North Queensland.)].. *turneri* Rohwer.

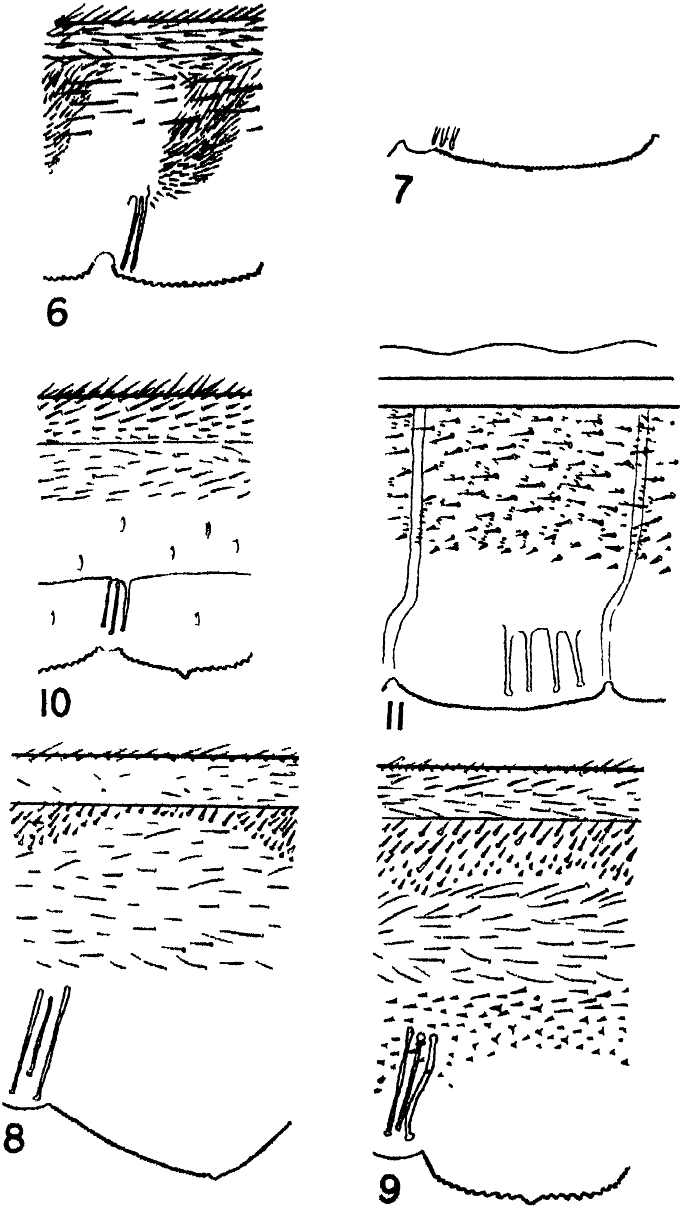
Hind basitarsus in front very little greater in length than the following segment; side-portion of pronotum cut off by accessory furrow, at its greatest breadth at least as broad as the length of the malar space: abdomen with at least segments 3 and 7 completely banded right round with yellow .... 4.

4. Mesonotum with side-lobes shining between sparse punctures .... 5.

Mesonotum dull, with coriaceous surface between small regular punctures.
[Species coloured as in *P. cinctus* Klug, with short antennæ, about ½ length of fore wing, and malar space about ½ length of clypeus. (New South Wales.)] ...... *distinctus* Rohwer.

5. Malar space very long, more than ½ breadth of mandible at base, band on tergum 3 more orange in colour than scutellum; larger species (females examined 13–16 mm. long); ♀ saw with about 50 denticulations to 10th tooth from apex (fig. 7)............................... 6.

Malar space less than ½ breadth of mandible at base; band on tergum 3 is lemon-yellow as is scutellum; smaller species (♀♀ examined 11–14 mm. long); ♀ saw



Tenth tooth from the apex of the saw in (6) *Pterygophorus cinctus* Klug, (7) *P. facielonga*, sp. n., (8) *Platypsectra leachi* (W. F. Kirby), (9) *P. opimus* (Konow), (10) *P. ramosus*, sp. n., and (11) *Pteryperga galla*, sp. n.

with from 28 to 40 denticulations to 10th tooth (fig. 6). (New South Wales and Victoria.) .... *cinctus* Klug complex.

6. Hind tibia and tarsi entirely yellow; orange band on abdomen covers at least the whole of segment 3 and most of 2, while the pale colour on tergum 7 spreads right round to include the hypopygium; infuscation of wings brownish and the veins in the apical ⅓ of fore wing as well as in hind wing are brown.
[Antennæ black, with 7 or 8 basal flagellar segments pale. (North Queensland.)] .... *insignis* W. F. Kirby.

Hind tibia with apical ⅔ and hind tarsi mostly black; orange band on abdomen mostly confined to segment 3; hypopygium black; infuscation of wings blackish brown and the venation in both wings (except stigma and costa) are black.
[Antenna and apparently in every structural character as in *P. insignis* W. F. Kirby, of which this may really represent a subspecies. (Victoria to South Queensland.)] .... *facielonga*, sp. n.

Pterygophorus facielonga, sp. n.

♂♀. *Colour* black, with the following parts yellow; 7 or 8 basal segments of flagellum, pronotum (except the front margin and the portion cut off by the accessory furrow, scutellum and sometimes the metascutellum, a patch occupying the larger part of the mesopleura behind, the basal ⅓ and underside of all the tibiæ, and (with a brown tinge) more or less the outer side and base of each tarsal segment, and of the abdomen segment 3 right round (with an orange tinge) spreading in part on to segments 2 and 4, the conspicuous membrane between terga 6 and 7, together with tergum 7 (except for the hind margin in the middle), the sides of tergum 8, and the anal segment; wings yellowish hyaline, with a deep fuscous band covering the upper part of the fore wing from the basal vein to the apex of the wing, including almost the whole of the 1st discoidal cell and the upper half of the 2nd and 3rd cubital cells; disc of stigma and costa brown; lower margin of stigma, subcosta, and rest of venation black.

Length 13–16 mm.; fore wing 13–16 mm.; antenna 5–6 mm.

Pubescence short and fine and evenly distributed over the whole insect except on the sides of the terga

1 to 3, the mesosternum, mesepimerum, and metepimerum. *Puncturation*, the whole of the head and thorax is smooth and shining, with very minute and shallow punctures on head and mesonotum; abdomen with coriaceous surface on dorsum.

Head long, with eyes converging strongly in front, so the length of the eye is greater than the distance between the eyes in front; malar space long, more than ½ as long as breadth of mandible at base; mouth-parts long, the labium being about 1½ times as long as the middle of the clypeus; ligula about as long as 3 basal segments of labial palp; clypeus small, so that its breadth is at most ⅔ the length of an eye, and very slightly emarginate in front, almost truncate; antenna 23–25 segmented, and more than ½ as long as a fore wing; basal segments of flagellum about as broad as the preapical segments; postocellar area very finely and faintly punctured all over, a little more than 1½ times as broad as long (about 16 : 9), when the length is taken at the side and measured as far back as the hind margin of the head when viewed from above and the breadth is taken in the front and broadest part.

Thorax, accessory furrow of pronotum well developed and subparallel with side-margin; the portion of the pronotum cut off by it is about twice as broad behind as in front (*cf.* fig. 5); the breadth behind is about equal to the length of the malar space and the middle of the clypeus; hind basitarsus very little greater in length than the following tarsal segment.

Abdomen, membrane between terga 6 and 7 abnormally exposed and bulging between the terga; saw as in fig. 7, with about 50 denticulations to the 10th tooth. Male as in female except for the antennæ and genital segments; the hypopygium is bent up almost erect.

Length 11·5 mm.; antenna 6 mm.; fore wing 10·5 mm.

The following types are in the British Museum:—

New South Wales: Woodford, 1 ♀, 27. i. 1913, *G. A. Waterhouse* (holotype); Cumberland, 1 ♀ (*R. E. Turner*, 1909—220); Sydney, 2 ♀♀, *C. Gibbons*; Sydney, Maronbra, 1 ♀, 29. ix. 1912, "on flower of Eucalyptus," *A. Musgrave*; Hunter River, 1 ♀, *MacGillivray* (1844—105); Narrabim, 1 ♂, *A. Burns*. Queensland: Burpengary, 1 ♀, *T. L. Bancroft* (1904—93). Victoria: Windsor, 1 ♀, 29. xii. 1917, *B. F. Hill.* AUSTRALIA : 1 ♀, without other data.

The following types are in the Victoria Museum :—

NEW SOUTH WALES : La Perouse, 1 ♂ (allotype), 12. x. 1921 ; 1 ♀, 11. iv. 1917, *C. French.* VICTORIA : Lilyvale, 1 ♀ ; Windsor, 1 ♀, 29. xii. 1917, *B. F. Hill*; 1 ♀, without further data.

PLATYPSECTRA, gen. nov.

Key to Species.

1. Pronotum entirely black ; hind basitarsus in front about 1½ times as long as the following tarsal segment.

[Accessory furrow of pronotum sub-parallel with side-margins of pronotum, often nearly obsolete in front ; ligula about as long as the 2 basal segments of the labial palp.] .... 7.

Pronotum mostly yellowish white ; hind basitarsus in front scarcely longer than the following tarsal segment.

[Except in *P. cygnus* W. F. Kirby and *P. zonalis* Rohwer the accessory furrow in front strongly converges and almost meets the side-margin, and the ligula except in *P. cygnus* W. F. Kirby, is at least as long as the 3 basal segments of the labial palp.] 2.

2. Malar space less than ½ length of middle of clypeus and ligula shorter than breadth of clypeus ; mesopleura at most sparsely covered with pubescence ; postocellar area at least about ¾ as long as broad ; ♂ hypopygium normal .... 3.

Malar space about equal to length of middle of clypeus and labium is about as long as breadth of clypeus ; mesopleura densely covered with fine short pale pubescence ; postocellar area about twice as broad as long ; ♂ hypopygium turned up almost erect apically.

[Abdomen black, with an orange band covering the whole of segments 2 to 5 ; ligula as long as 3 basal segments of labial palp ; ♀ antenna about ⅓ length of fore wing and club-shaped ; the basal flagellar segments are without prolongations and are about ¾ as long as broad, while the apical segments are a little produced beneath and are 2 or 3 times broader than long ; 7 or 8 basal segments of flagellum pale ; pronotal accessory furrow sub-parallel with side-margin of pronotum. (North Queensland.)] .... *zonalis* Rohwer,

3. Abdomen mostly steel-blue ; the pale is confined to the sterna and the anal

tergites and perhaps the intersegmentary membranes. .... 5.

Abdomen mostly yellow, with black markings apically beneath .... 4.

4. On hind legs tibiæ and tarsal segments each black-ringed apically; costa black; front lobe of mesonotum and pronotum as well as dorsum of abdomen with very sparse pubescence; labium much reduced, so that its total length (excluding palps) is about ½ the breadth of the clypeus, and the small lobes of the ligula do not reach beyond segment 2 of the palp; ♀ flagellum of antenna with a well-developed comb, so that every segment except the apical one has a prolongation on the underside and, in the middle segments, the prolongation is 2 or 3 times longer than the basal breadth of the segment. (Western Australia.) .... *cygnus* W. F. Kirby.

On hind legs tibia and basal tarsal segments entirely pale, only the 2 apical tarsal segments being infuscate; costa yellow; front lobe of mesonotum, pronotum as well as the middle of the basal terga of the abdomen densely pubescent; labium almost as long as the clypeus is broad, and the lobes of the ligula are at least as long as the 3 basal segments of the labial palp; ♀ flagellum of antenna with a small projection from the apex of only the 8 or 9 basal segments; the length of the projection is nowhere more than the basal width of the segment bearing it.

[In this group there is considerable variation in the proportion of the length to breadth of the postocellar region, the distance of the ocelli from the eyes compared to the distance of the ocelli from each other, the length of the antennæ, the extent of black colour at the apex of the abdomen and hind parts of thorax, the extent of infuscation of the fore wings, the colour of the stigma, etc., but it must at present be regarded as comprising one species only, because up to the present all these variations seem to be linked together with intermediates, are not, so far as is known, isolated geographically or ecologically from one another, and have saws that are indistinguishable from each other. (Victoria to North Queensland.)] .... *interruptus* Klug complex.

5. Wings fusco-violaceous throughout (except, at most, the anal lobe of the hind wing); dorsum of abdomen shining, almost glabrous, with at most only sparse hairs in the middle of the basal terga and hind margins of apical terga .... 6.

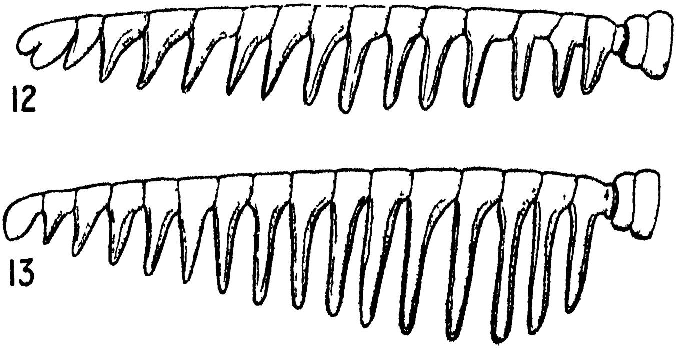
Wings subhyaline except for a fuscous blotch under the stigma of the fore wing; abdomen with transverse rugulose sculpture and dense patches of minute hairs especially on the middle of the basal terga. [Front lobe of mesonotum with sparse pubescence; saw as in *P. opimus* (Konow). (Victoria and New South Wales.)] .... *cyaneus* Leach.

6. Smaller species (under 14 mm. long); front lobe of mesonotum with pubescent patches; saw (fig. 8). (Queensland.) ... *leachi* W. F. Kirby.

Larger species (those measured being 18–19 mm. long); front lobe of mesonotum entirely glabrous; saw (fig. 9). (Victoria.) *opimus* Konow.

7. Wings subhyaline except at most for an infuscate patch, in the ♀, under the stigma of the fore wing mostly confined to the radial cell .... 9.

Wings more or less infuscate throughout; the radial cell of the fore wing in neither sex is more densely infuscate than the middle of the wing .... 8.



Female antenna of (12) *Platypeectra analis* (Costa) and (13) *P. ramosa*, sp. n.

8. Hind legs black except for the extreme base of the tibia and tarsus; ♀ with prolongations to basal flagellar segments of antenna about 3 times as long as those to the preapical segments; the distance between the antennal sockets in ♀ about as long as the malar space. (Victoria.) .. *nigripes*, sp. n.

Hind tibia with the basal half pale, and metatarsus pale except for extreme apex; ♀ with prolongations to flagellar segments very short, those of the basal segments being no longer than those of the apical segments; distance between antennal sockets in ♀ about twice as long as the malar space. (Queensland, MacKay.) ... *uniformis* W. F. Kirby.

9. ♂♂ .... *analis* Costa or

♀♀ .... 10. [*ramosa*, sp. n.

10. ♀ prolongations to middle flagellar segments of antenna about 1½ or twice as long as those at base and apex (fig. 12). (Victoria to Queensland and Western Australia.) .... *analis* Costa.
♀ prolongations to flagellar segments of antenna longest towards base of antenna, where they are 2 or 3 times longer than those at apex of antenna (fig. 13). (Victoria.) .... *ramosa*, sp. n.

Platypsectra nigripes, sp. n.

♀. *Colour* black with steel-blue sheen; abdominal segments 2–7 yellow; labrum, apex of fore femur, front of fore tibia, extreme base of middle and hind tibiæ, with base of metatarsus on all legs brownish white. *Wings* deeply infuscate throughout; stigma and venation black.

Length 9 mm.; fore wing 7 mm.; antenna 4 mm.

Pubescence sparse on mesothorax, mostly absent from dorsum of abdomen, elsewhere evenly distributed.

Head, labium shorter than the breadth of the clypeus; clypeus almost truncate in front, with a medial longitudinal groove and with a transverse depression covering the front ½ of each side; clypeus slightly less in breadth than length of an eye; eyes slightly concave on their inner margins and converging a little in front; length of eye about ⅗ distance between eyes in front; malar space, pedicel of antenna, and distance between antennal sockets about equal in length; antenna 18-segmented; all the flagellar segments bearing apical ventral prolongations, those on the basal segments being the longest—about 3 times as long as the breadth of the segment and also about 3 times as long as the prolongation on the preapical segment; frontal crest raised slightly and triangular in shape, the hind ocelli forming the two hind corners; frontal furrow broad and not clearly defined; POL=OOL; postocellar area about ½ as long as broad.

Thorax with accessory furrow to pronotum not clearly marked, almost obsolete in front for ⅓ of the way, and behind indicated by a rounded groove; portion of pronotum behind cut off by this groove is about twice as broad as the malar space is long; hind metatarsus about 1½ times as long as the following tarsal segment.

Abdomen as in *P. analis* Costa.

VICTORIA: Studley Park, 1 ♀ (holotype) (Victoria Museum).

Platypsectra ramosa, sp. n.

♀. *Colour* black with steel-blue sheen on head, thorax, and on the abdominal terga 8–10 and sometimes also tergum 1; legs black except on front legs for apical half of femur, with whole of tibia and tarsi, on middle and hind legs except for the femur, the basal ½ or ⅔ of the tibia as well as the basal ½ of the metatarsus. *Wings* hyaline except for a fuscous patch in the fore wing occupying the radial cell and more or less the first 2 cubital cells and also the anal margin; costa white basally and brown apically; stigma and rest of venation blackish brown.

Length 10·5 mm.; fore wing 10 mm.; antenna 3·5 mm

Pubescence thick on head, pronotum, front lobe of mesonotum, mesopleuræ, the apical sterna of the abdomen with their corresponding ventral portions of abdominal terga, and the terga 8–10 above; the hinder parts of thorax, with base of abdomen above and below, are sparsely pubescent, almost glabrous.

Head as in *nigripes*, sp. n., but that the antenna is 18–19-segmented and the prolongations to the basal segments are about 4 times as long as the breadth of their respective segments, the longest being borne by flagellar segments 4–6, whose prolongations are 2 or 3 times longer than those of the preapical segment (fig. 13); the frontal crest is also much more clearly raised and is bisected medially by a distinct deep parallel-sided channel joining the medial fovea to the frontal furrow.

Thorax as in *nigripes*, sp. n., but with accessory furrow to pronotum more clearly indicated, being obsolete only in its front half.

Abdomen with saw as in *P. analis* Costa (saw, fig. 10).

VICTORIA: Melbourne, S. Yarra, 1 ♀ (holotype), *F. du Boulay* (British Museum, 1885—108); Sunshine, 1 ♀, 22. iii. 1919, *C. E. Cole* (British Museum); Windsor, 1 ♀, *B. F. Hill* (Victoria Museum).

PTERYPERGA, gen. nov.

♀. *Head*, when viewed from the front, broader than long (in about the proportion of 4 : 3); labial palp 4-segmented; maxillary palp 6-segmented; labrum flattened or slightly emarginate apically, and appearing more than twice as long as the clypeus; clypeus small (in breadth being less than half the distance between the eyes below and in length about equal to the pedicel of the antenna); eyes about ⅔ as long as the distance between the eyes below, converging a little in front and slightly concave on the inner side (fig. 3); also the distance of the antenna behind the clypeus about equal to the pedicel of the antenna; malar space equal to about the breadth of the pedicel; antenna 12–20-segmented; serrated below by each segment being swollen out apically below to about twice its basal breadth.

Thorax with no accessory furrow to pronotum (fig. 4); scutellum simply rounded behind, without side-lobes; wing venation as in *Pterygophorus cinctus* Klug; the basal vein of the fore wing is received on the costa at the junction of the cubitus; 2nd cubital cell receives both recurrent veins owing to the disappearance of the 2nd transverse cubital vein; the anal cell is wanting; in the hind wing the radial cell is open at the extreme apex; hind and middle tibiæ with preapical spines. *Abdomen* as in *Pterygophorus cinctus* Klug, the propodeum being scarcely emarginate behind and the membranous area very small.

Type *Pteryperga galla*, sp. n.

This genus would run to the Perginæ in my key to the subfamilies (Benson, 1935, pp. 222–224) of the Pergidæ, but differs from this group in that the scutellum is simple and without hind lobes; the radial cell in the hind wing is open at the extreme apex, the second transverse cubital vein in the fore wing is absent, and there is a well-developed first parapterum.

In the structure of the metapleura it agrees closely with the Perginæ. Provisionally therefore it is placed in a new subfamily, Pteryperginæ, of the Pergidæ. The relationship between these two subfamilies is being dealt with in more detail in a forthcoming paper on the classification of the sawflies.

Pteryperga galla, sp. n.

♀. *Colour* black; reddish brown are the labrum, clypeus, and face to include front inner orbits and frontal area, pronotum, margins of front mesonotal lobe, band across scutellum, metascutellum, upper ⅓ of mesopleura, 3 basal tarsal segments and abdomen (except tergum 1, middle of tergum 2, and apex of saw-sheath). *Wings* fusco-hyaline, with a blackish band stretching across fore wing from under the stigma to the hind margin; patches of the same colour fill the intercostal area, cover the basal and anal veins, and fill the extreme base of the fore wing; in the hind wing there is a slightly fuscous band stretching across from the stigma and a patch covers the anal veins; stigma and venation black.

Length 11 mm.; fore wing 10 mm.; antenna 3 mm.

Structure, whole surface smooth and shining, almost impunctate and covered with sparse pubescence.

Head, antenna 12-segmented; distance between insertions of antennæ about 1½ times the diameter of the front ocellus; median fovea obsolete; extreme margin of frons bordering the antennal insertions behind is carinate, and extending backwards from the middle of each of the margins surrounding the antennal sockets is a very short ridge—just outside each antennal furrow; extending from one hind ocellus to the other hind ocellus round the front of the front ocellus is a U-shaped ridge enclosing the front of the ocellar basin (fig. 3); vertical furrows clearly defined and strongly diverging behind, so that the postocellar region is much broader behind than in front (in about proportion of 6 : 5); postocellar area about 3 times broader behind than long; distance between hind ocelli slightly greater than the distance of one of them from the hind margin of the head.

Thorax (except pronotum), *wing venation*, and *abdomen* as in *Pterygophorus cinctus* Klug, but the saw-sheath is narrower and projects well beyond the anal segments of the abdomen; saw (fig. 11); saw-sheath viewed from above is bifid, with a small third middle tooth, the outer lobes being clothed apically with strongly curved hairs.

New South Wales: Tweed River, 3 ♀♀, bred from cocoons collected by H. Brooke (holotype and one paratype at Canberra, one paratype retained in British Museum), also 1 ♀ with same data (presented by W. W. Froggatt to the British Museum 1918—42) and 1 ♀ with the same data (in the Australian Museum); also 3 ♀♀, Dorrigo, *W. Heron* (in the South Australian Museum).

This species, as mentioned above, was considered by Froggatt (1918) to belong to *Pterygophorus bifasciatus* Brullé (Tasmania), which is unlikely; at the same time Brullé's species (see description and figures by Brullé, 1846) probably represents a second species belonging to *Pteryperga*; the wing-patterns do not quite agree; Brullé makes no mention of the preapical tibial spurs and also he describes and figures the antenna as 20-segmented.

Brullé's type is now lost.

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LXXII.—*A Note on the Trachelifer Larva of* Jaxea nocturna (*Chicreghin*) *and its Metamorphosis.* *By W. M. TATTERSALL, Department of Zoology, University College, Cardiff.

THE Trachelifer larva was so named by Brook (1889) for specimens collected in the Clyde area. It had, however, been previously described by Claus (1884) as the Zœa stage in the life-history of an unknown Macruran Decapod. In 1886 Claus described older specimens of this larva in the Mysis stage and very near to the period of metamorphosis into the postlarval form. The actual metamorphosis was not observed by Claus, but, as a result of a close examination of the external characters of the larva, and especially of the number and arrangement of the gills, he deduced that it belonged to *Calliaxis adriatica* Heller, now regarded as a synonym of the earlier described species, *Jaxea nocturna* (Chiereghin).

[After this note was in print, Dr. Calman drew my attention to the two papers by Caroli, quoted in the list of references given below, which I regret to have overlooked. In the first paper Caroli gives a figure of the post-larval *Jaxea*, which metamorphosed in the laboratory at Naples from Trachelifer caught in the plankton. In the second paper he describes in detail (including the appendages) all the stages in the development of *Jaxea* from the earliest Trachelifer to the post-larval stage. My observations agree in every way with those of Caroli, and confirm the brilliant deduction made by Claus over fifty years ago as to the adult species to which the Trachelifer larva belongs.]

The specimens of the Trachelifer larva which are the subject of this note were collected during July and August, 1937, at Lough Ine, near to Skibbereen in the south-west of Ireland. Lough Ine is an almost landlocked area of water communicating with the outside sea by a rather narrow channel across which is a natural weir formed of rocks and boulders overgrown with sea-weeds of all kinds. The weir impedes the passage of the tide, with the result that the tide-level rises or falls more quickly outside the lough than it does inside. Water therefore enters or leaves the lough at considerable speed except immediately before and after high-water. The incoming strong current of the tide enters the lough and flows directly up against a sheer wall of rock some two hundred yards inside the lough entrance. The result is that an eddy is set up, and the incoming planktonic organisms are swirled to the surface in the upwelling water. On calm bright days all kinds of plankton animals can be observed at the surface in this pool, and may be collected by means of a shallow glass dish. In this way it is possible to collect individual planktonic organisms in an uninjured condition, whereas tow-netting invariably damages the specimens to a greater or less degree. It was in this way that the Trachelifer larvæ were collected. They were transferred to the laboratory and placed in finger-bowls and open glass vessels. Fresh sea-water, taken from the pool itself, was added as required, and in this simple way it was found possible to keep the larvæ alive for several days or even weeks. No attempt was made to feed them. The larvæ were quite common during July and August, and larval life is obviously fairly prolonged. The larvæ collected in July were not more than half-grown and in a stage of development corresponding to the late Zœa stage of other Decapod larvæ. It was only towards the end of August that the older larvæ in the Mysis stage were found. I should judge that the larval life of the Trachelifer is certainly at least a month and probably more in duration. The late larvæ, collected towards the end of August, commenced to undergo metamorphosis after two or three days in the finger-bowls. Metamorphosis always took place at night, so that the actual process was not observed, but from an examination of the cast skins it would appear that the Trachelifer larva splits transversely on the dorsal surface at the junction of the thorax and abdomen and the postlarval stage emerges at this point. The larva is normally transparent and very difficult to see as it swims in water. When, however, metamorphosis is about to take place the central region of the body, comprising the thorax and its appendages, becomes opaque, and takes on a pinkish colour. At the same time the larva ceases its jerky swimming movements and sinks to the bottom of the bowl. At first I thought the opacity and cessation of movement heralded the death of the larva, but I soon discovered that, on stimulation, the larvæ were quite active and well. By next morning the opaque larva had metamorphosed into the postlarval stage.

The Trachelifer larva at the stage when metamorphosis sets in is shown in fig. 1. It differs from the larva first figured by Claus (1884) in having a much longer neck and in the shape of the telson. In both these features it agrees with the figures given by Brook (1889) and Scott (1899). The larvæ figured by Claus are smaller than any I have myself observed. The youngest measured only 3·5 mm., and it was from this specimen that Claus's fig. 48 was taken. He does not give the length of the specimen from which his figure of the telson (fig. 50) was drawn, but the figure shows the telson to be rather deeply forked, with only five setæ on the inner margin of each fork. In all specimens which I have examined the telson is as shown in fig. 2, with the posterior margin transverse between two long lateral spines and with about twenty setæ on this margin. These differences are doubtless due

Fig. 1.

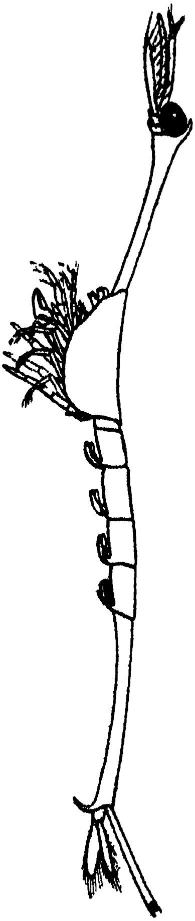


Fig. 2.

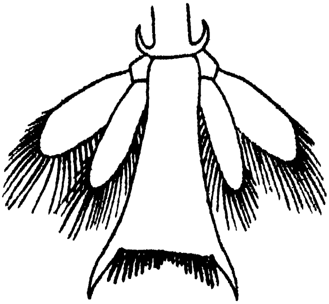


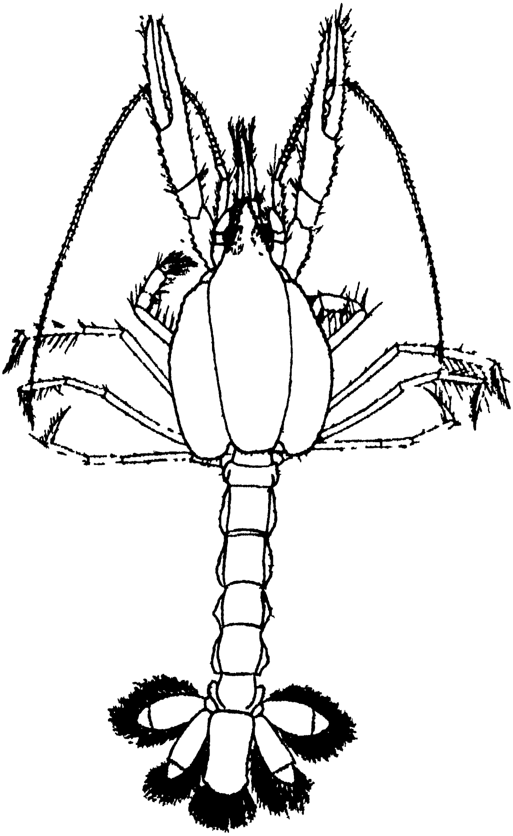
Fig. 1.—Trachelifer larva of *Jaxea nocturna* (Chiereghin) immediately before metamorphosis. × 7·5.

Fig. 2.—Telson and uropods of the same larva as in fig. 1, dorsal view. × 18.

to differences in age and stage of development. [Caroli (1924) has shown quite clearly that this is the case.]

Claus (1886) figures the thoracic region of the larva immediately before metamorphosis, and this figure agrees with my specimens. The larva at this time has the five walking-legs developed, the fifth, however, being quite rudimentary. The first four have exopods, that of the fourth pair a mere rudiment. Four pairs of pleopods are present.

Fig. 3.



Post-larval stage of *Jaxea nocturna* (Chioroghin) immediately after metamorphosis. × 12·5.

The Trachelifer larva attains a length of between 12–15 mm. before metamorphosis, and the postlarval *Jaxea* which emerges from the larva is about 6·5 mm. in length from the apex of the rostrum to the telson. It is in all respects and essential characters a miniature adult *Jaxea*, the differences from the fully grown adult which are found to exist being such as would disappear with age and growth. Fig. 3 shows the newly hatched form of this species. I have compared the specimen with the description and figures of an adult measuring 41 mm. given by Selbie (1914), and find the following differences:—

(*a*) The antennal scale is relatively longer in the young stage than in the adult, and is about one-third of the length of the peduncle.
(*b*) The second joint of the palp of the maxillule is shorter and thicker than in the adult.
(*c*) The endopod of the maxilla appears to be two-jointed in the young stage. Selbie figures it as a single joint in the adult.
(*d*) The first joint of the endopod of the third maxillipeds is armed by nine coarse teeth on the inner margin, and there are three similar teeth on the second joint. Selbie does not figure any teeth in this position in the adult, but Heller (1863) shows them as present in the specimen he described.
(*e*) The dactyli of the second to the fifth walking-legs are longer and more slender than in Selbie's figures of the adult limbs, and those of the third and fourth legs are devoid of the armature of teeth described by Selbie.
(*f*) The fifth walking-leg is relatively longer compared with the third and fourth legs than in the adult.
(*g*) There is a more obvious and conspicuous armature of small spines, especially on the rostrum and on the antero-lateral margins of the carapace, and on the margins of the chelæ, than is shown in the adult.
(*h*) The eye is relatively larger than in the adult.

These differences are small in themselves, but indicate the nature of the changes which are undergone with successive moults towards the adult condition. [These differences were noted by Caroli (1924).] The most interesting of the differences is that seen in the relative size of the eye. This difference is readily seen on comparing fig. 3 with Selbie's figure. The progressive diminution in the relative size of the eye is doubtless associated with the burrowing habits of the adults.

From the observations I have made on the metamorphosis it seems clear that the Trachelifer larva sinks to the bottom when about to metamorphose, and that metamorphosis actually takes place on the sea-floor, so that the postlarval form is able at once to assume the burrowing habits of the adult phase. I have never collected the adult *Jaxea* at Lough Ine, though the bottom of the lough is ideally suited to it, since it is composed in large part of a soft muddy sand such as is frequented by the adult.

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LXXIII.—Cucumaria tetracentriophora, *sp. n.*, *a new Dendrochirote Holothurian from South Africa.* By S. G. HEDING, Zoological Museum, Copenhagen.

Diagnosis.—Medium sized dendrochirote Holothurians with ten equal tentacles and large normal tube-feet confined to the five ambulacra and to the mid-dorsal interambulacrum, and with small papulæ-like tube-feet scattered all over the four ventral and lateral interambulacra. With five large anal teeth, a solid cartilaginous-like calcareous ring without posterior processes, one polian vesicle, one stone-canal, and well-developed respiratory trees. Calcareous deposits in body-wall of two kinds, an outer layer of minute four-spined curved rods and an inner layer of large oval or egg-shaped knobbed plates without any spiny projection. Terminal plate of tube-feet lacking even in the large, well-developed, ventral radial tube-feet.

Systematic Position.—This species is very like several of the common South African species, but differs mainly in having four-spined rods in the body-wall, in having all the tentacles of equal size, in having no spiny projections on the knobbed plates, and in lacking the terminal plates of the tube-feet.

Locality.—South Africa.

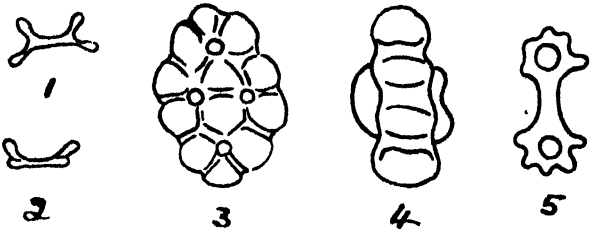
Type-specimen.—In British Museum (Natural History).

Material.—

South Africa, leg. Dr. P. D. Hahn (type)	6 specimens.
South Africa	10 ,,
South Africa, Bonza Bay, East London ; leg. Prof. Stephenson, 22. vii. 37	2 ,,

Description.—The specimens at hand measure about 3 cm. in length, but as they are all strongly contracted the normal size of mature specimens may be about 8 cm. The colour of all the specimens except two, those from Bonza Bay, is almost uniformly yellowish white, a little darker dorsally, where there is a purple tinge. Those from Bonza Bay are steel-grey with a lot of black or blackish-purple spots. The body-wall is thick and leathery (in contracted specimens) and its surface is soft to the touch. The tube-feet are rather large and quite retractile. They form broad rows, each with four to six feet in the three ventral radii and narrow double rows in the dorsal radii. Besides, there are a number of slightly smaller tube-feet scattered over the dorsal interambulacrum. A closer examination shows, however, that there are a lot of minute papillæ, quite papulæ-like, densely spread all over the interradii. Contrary to what is the case with the large tube-feet, these papillæ are not supplied with any ampullæ, and as far as can be seen there are also no deposits in them. They are all quite retracted, but may easily be seen on the surface by means of a lens, and by removing the ring-muscle layer from the skin proper it may be seen that each of these papillæ is connected with the water-vascular system. There are ten tentacles of equal size, five large anal teeth each with two anal papillæ, and a large cartilaginous-like calcareous ring without any posterior prolongations. The anterior processes of the radials and of the interradials are rather alike, and, as far as it is possible to ascertain, the radial processes have no, or at any rate only very faint, anterior incisions. The difficulty in ascertaining this is mainly due to the softness of the ring proper. There is one very large polian vesicle and one stone-canal. The gonads are long unbranched tubes.

The intestine has no muscular part, but consists of two very different characteristic parts, of which the one is smooth and longitudinally striped and the other is strongly folded transversely. The cloaca is short and the respiratory trees are large and much branched.



Figs. 1 & 2.—Four-armed rods from the outer layer of the body-wall; fig. 2 from the side.

Figs. 3 & 4.—Four-holed knobbed plates from the inner layer of the body-wall; fig. 4 from the side.

Fig. 5.—Normal rod from the walls of the tube-feet.

The calcareous deposits of the body-wall consist of two different sorts. The one form a thin but very dense layer of small, 30–40 μ long, four-armed rods. They are always slightly curved towards the arm-points (*i. e.*, the surface of the body-wall), and the arm-points, which normally are slightly distended (figs. 1 and 2), may divide, usually once but now and then two to three times. These deposits are very similar to, and may probably be regarded as homological with, the base or primary cross of the "baskets" known from allied species. The second sort of deposits in the body-wall proper are large oval four-holed knobbed plates, normally about 80 μ long (figs. 3 & 4). The shape of these plates is very characteristic, but the variation is rather great. As said above, there are normally four holes, but in a few cases there are but three, and rather often there may be five to eight.

More frequently than the number of holes increases the knobs of the surface grow so large that the holes almost disappear, and the plate becomes nearly egg-shaped, but in no case is one end of these deposits spiny or in any way different from the other.

The deposits in the tube-feet are rather variable, but their normal shape (fig. 5) is a short thick rod with extended and perforated ends. Rather often there is more than one perforation in each end, and these rods may have somewhat branched ends. There is no terminal plate in the tube-feet.

A very interesting thing is that intermediate stages are often found between all three sorts of deposits. Such are usually found in the vicinity of the tube feet, especially of the minute papulæ-like ones present in the interambulacra These minute pedicels are normally totally devoid of calcareous deposits, and in cleared pieces of skin they are seen as round patches without deposits, surrounded by deposits which are arm-rods as well as perforated rods.

For the opportunity of studying and describing this interesting species I wish to express my most cordial thanks to Mr. Dilwyn John.

LXXIV.—*A new Species of* Solenopotes (*Anoplura, Siphunculata*). By Gordon B. Thompson.

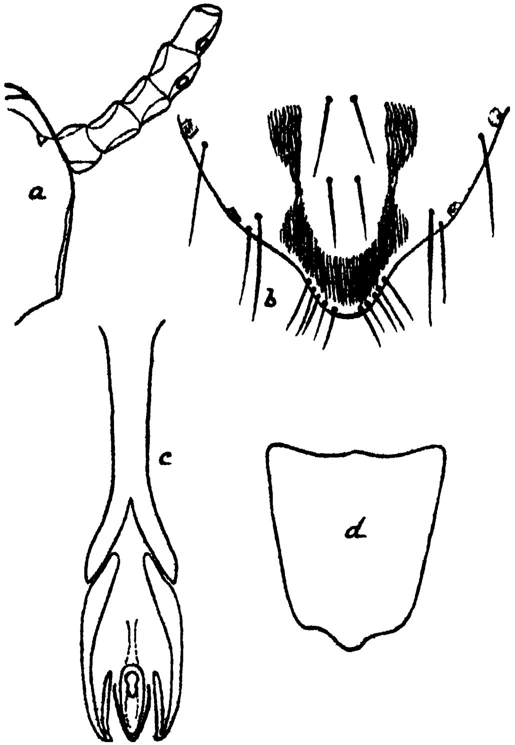
Solenopotes muntiacus, sp. n.

Type-host.—*Muntiacus malabaricus* Wroughton (S. Indian Barking Deer).

Specimens examined.—Holotype (♂), allotype (♀), and 8 ♀♀, 7 ♂♂ paratypes from the type-host, Ceylon, C.P., Mousakande, Gammaduwa, alt. 3400 ft., 9. xii. 1934 and 10. xi. 1935 (*W. W. A. Phillips*).

♂. Length ·8 mm.. ♀. Length 1·7 mm.

Female.—*Head* almost twice as long as broad, bluntly pointed; lateral margins from the junction of thorax to base of antennæ almost parallel. Entire head weakly sclerotic except for two areas on either side of the anterior portion. Occiput produced triangularly on to the thorax. Dorsal setæ few: six (3. 3) on the area between the base of the antennæ and ten (5, 5) roughly in a line across the head about halfway between the base of the antennæ and the posterior portion. Antennæ with sensoria present on each of the last two segments (see fig. *a*). *Thorax* with weakly sclerotic areas, which are somewhat difficult to discern; they appear for the most part to be outlined areas corresponding to the coxæ on the venter. There is an area extending from the apex of the posterior triangular projection of the head posteriorly, then outwards towards the sides just anterior to the spiracles. Two (1, 1) setæ just below the posterior lateral angles of the head and



Solenopotes muntiacus, sp. n.

a. Antennæ showing sensoria.
b. Genital plate of male.
c. Genitalia of male.
d. Sternal plate.

two (1, 1) rather longer setæ just inside and a little posterior to the spiracles. Sternal plate present, almost completely occupying the area between the coxæ. In the specimens at hand in which it is at all distinct it appears as drawn (see fig. *d*). Legs normal as for genus; very heavily sclerotic as compared with the remainder of the insect. *Abdomen* a little less than twice as long as broad; apparently membranous throughout except for the spiracular tubercles, the ninth tergite, and the genital area, but on closer examination the derm may be seen tending towards being sclerotic, the pattern of reticulations is quite well defined throughout. Each segment bears two long median setæ and a slightly longer one posterior to each spiracle, both dorsally and ventrally. Genital region almost identical with that of *S. binipilosus* (Fahrenholz).

Male.—Very similar to the female. Genital plate lyriform (see fig. *b*). Genitalia (see fig. *c*): basal plate deeply bifid at the posterior end; parameres narrow and tapering towards the end; penis, in the specimens at hand its exact form is difficult to discern, but it appears to be borne on a small narrowly ovoid plate situated between the extremities of the parameres. Apex of abdomen with a broad genital lobe.

The female of this species is very close to *S. binipilosus* (Fahrenholz). It differs in having two sensoria present on the last two antennal segments, in being less sclerotic, and in having fewer setæ on the abdominal segments. The genitalia of the male are unlike any other known species of the genus.

I wish to record my thanks to Prof. G. F. Ferris for having examined this species for me some time ago when only the females were available.

All the known species of the genus *Solenopotes*, except *S. capillatus* Enderlein, are parasitic on Cervidæ (Deer).

I should like to draw attention to a recent paper by Prof. L. Freund entitled "Die Europäische Hirsh- und Rehlaus," the separata of which bear no indication of the publication in which the paper appeared. The full title of the work in which it was published is "Parasites, Transmetteurs Animaux Vénimeux. Recueil de Travail dédié au 25me Anniversaire, Scientifique du Professor Eugéne Pavlovsky, 1909–1934," Leningrad and Moscow, 1935, pp. 275–281, Abb. A. & B.

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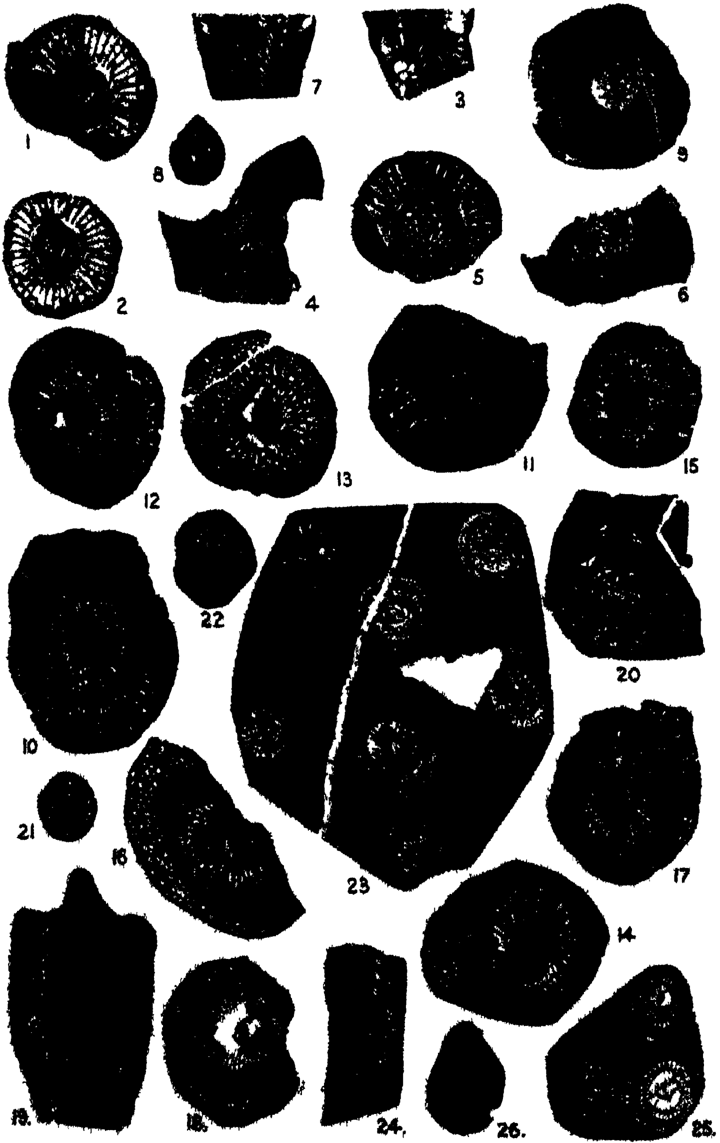

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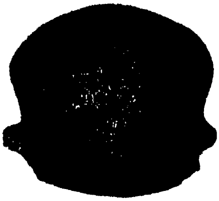
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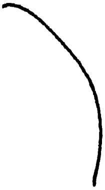
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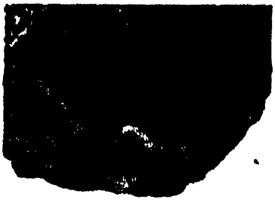
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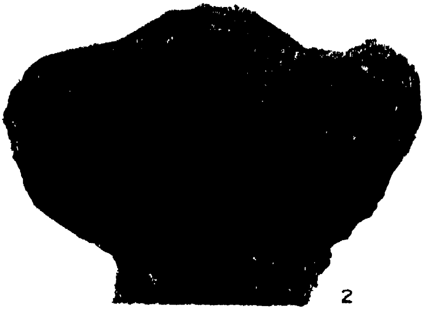
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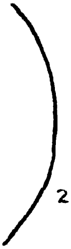
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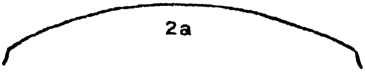
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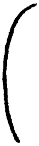
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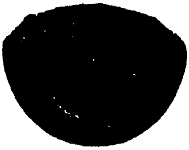
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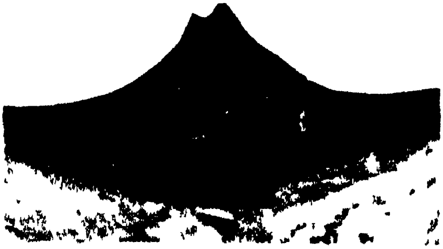
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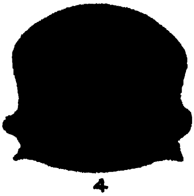
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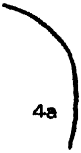
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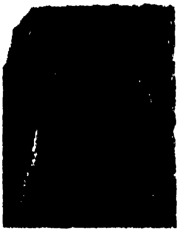
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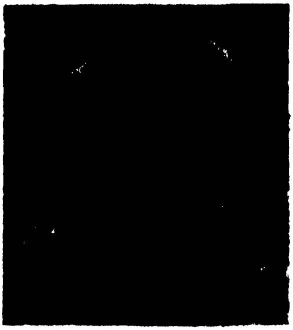
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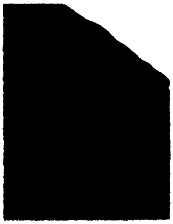
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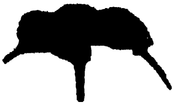
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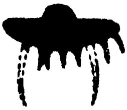
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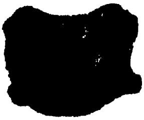

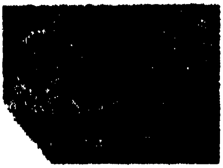

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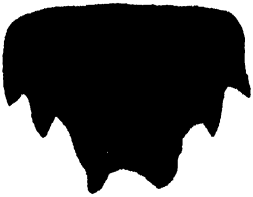

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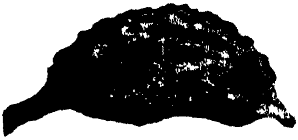

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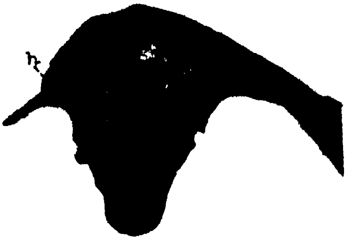

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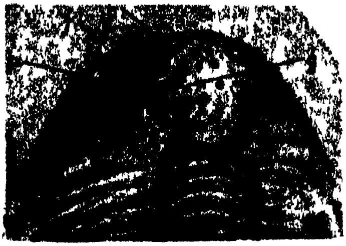

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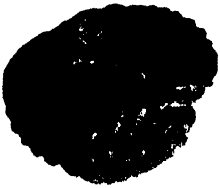
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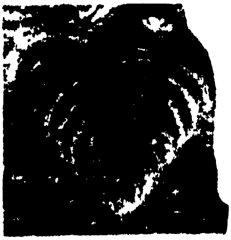
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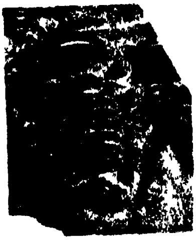
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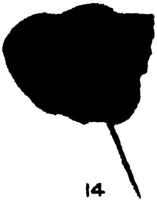
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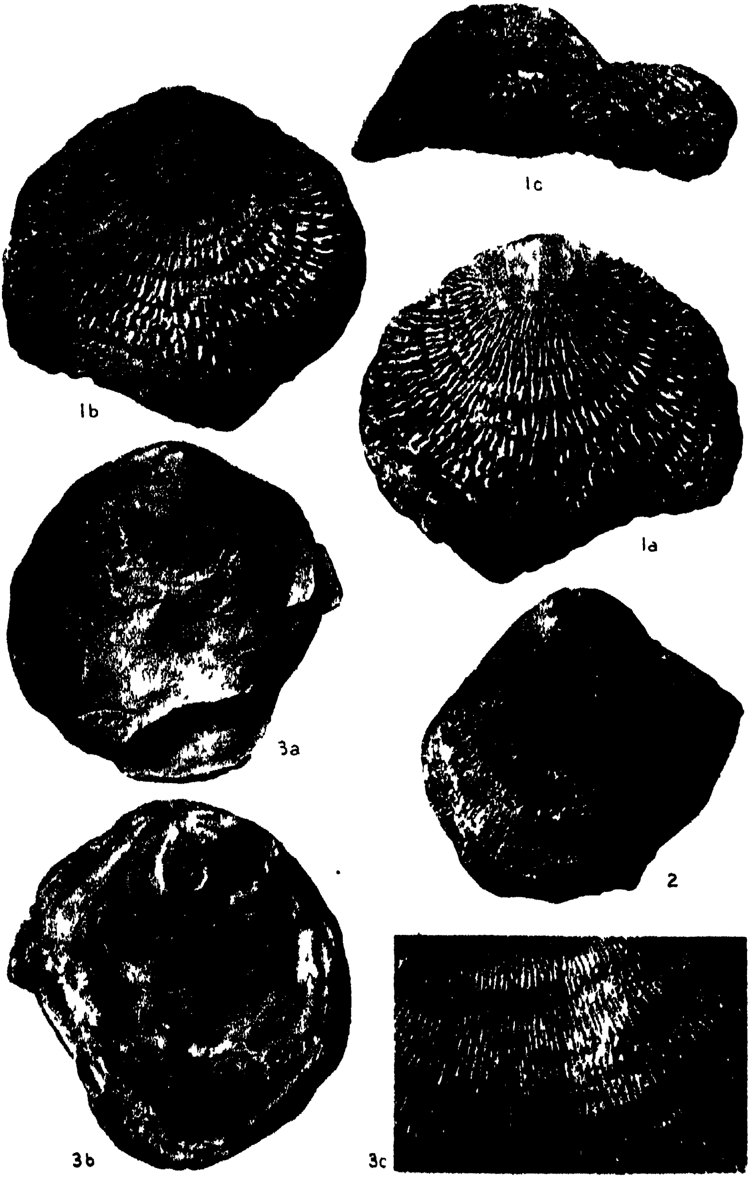

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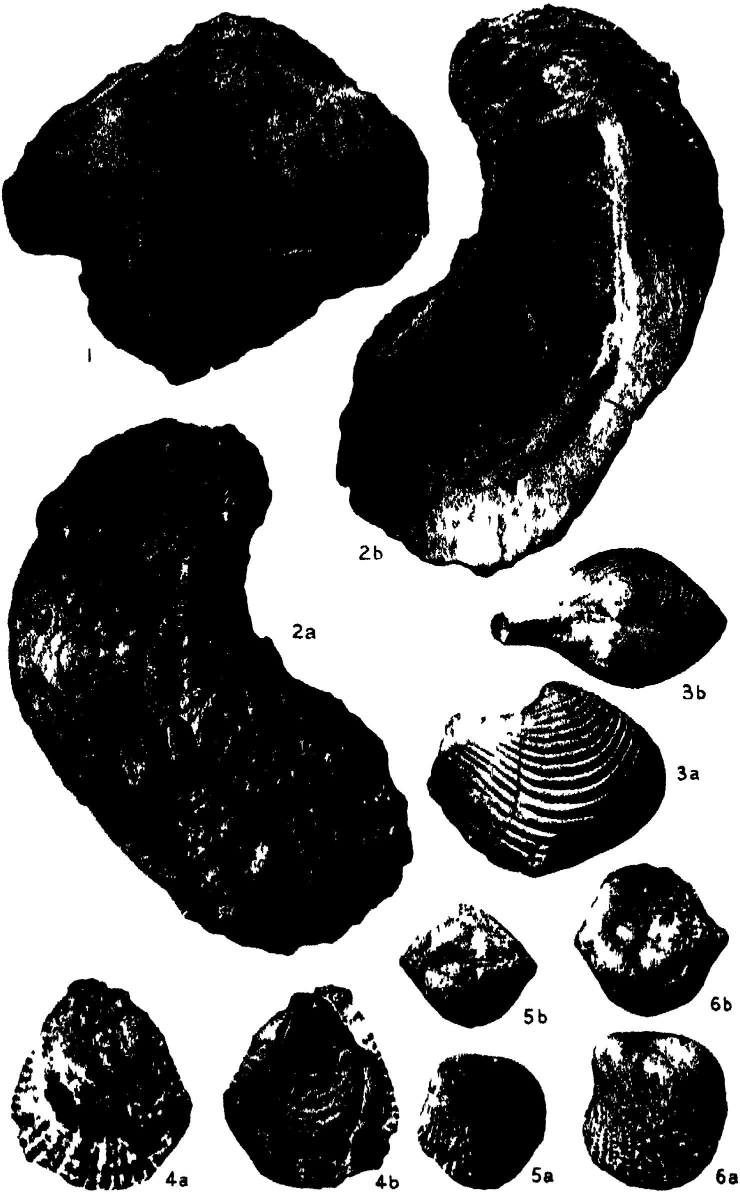

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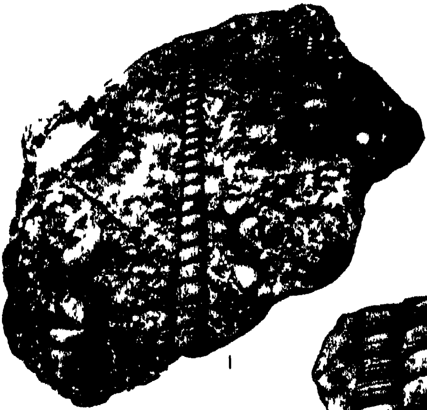

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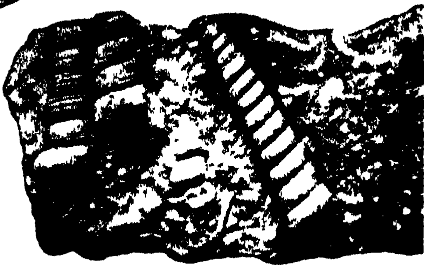

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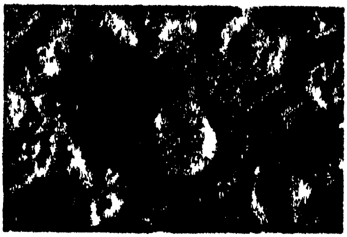

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MOLLUSCA FROM THE LOWER CHHARAT BEDS (EOCENE).

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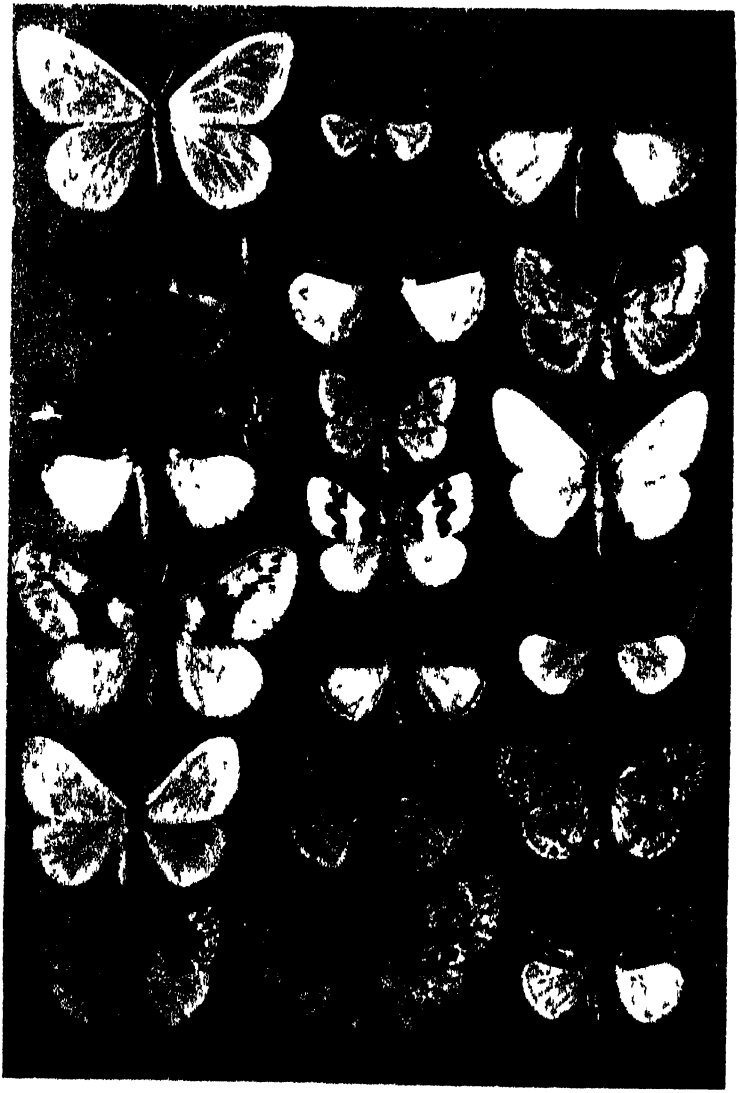

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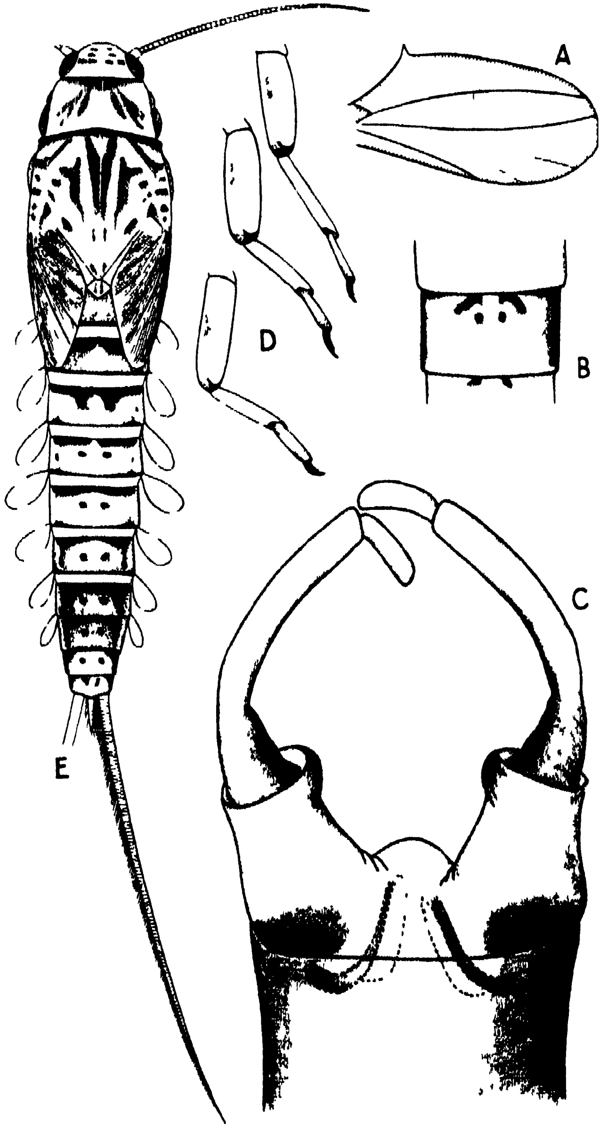


Baetis maurus, sp. n

FIG 1.

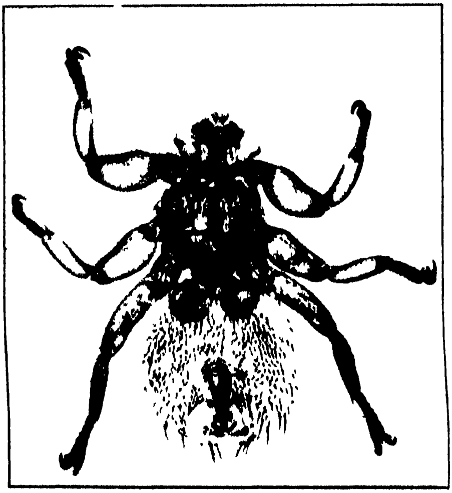
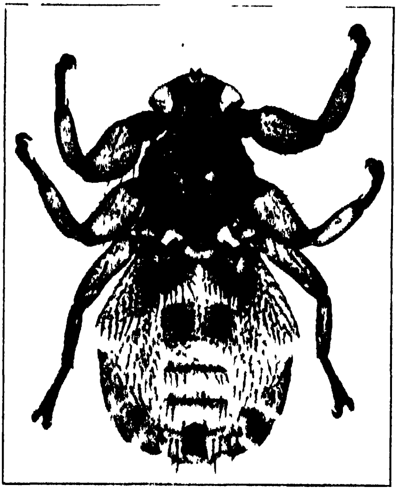


FIG. 2



Lipoptena efovea Speiser.

COX

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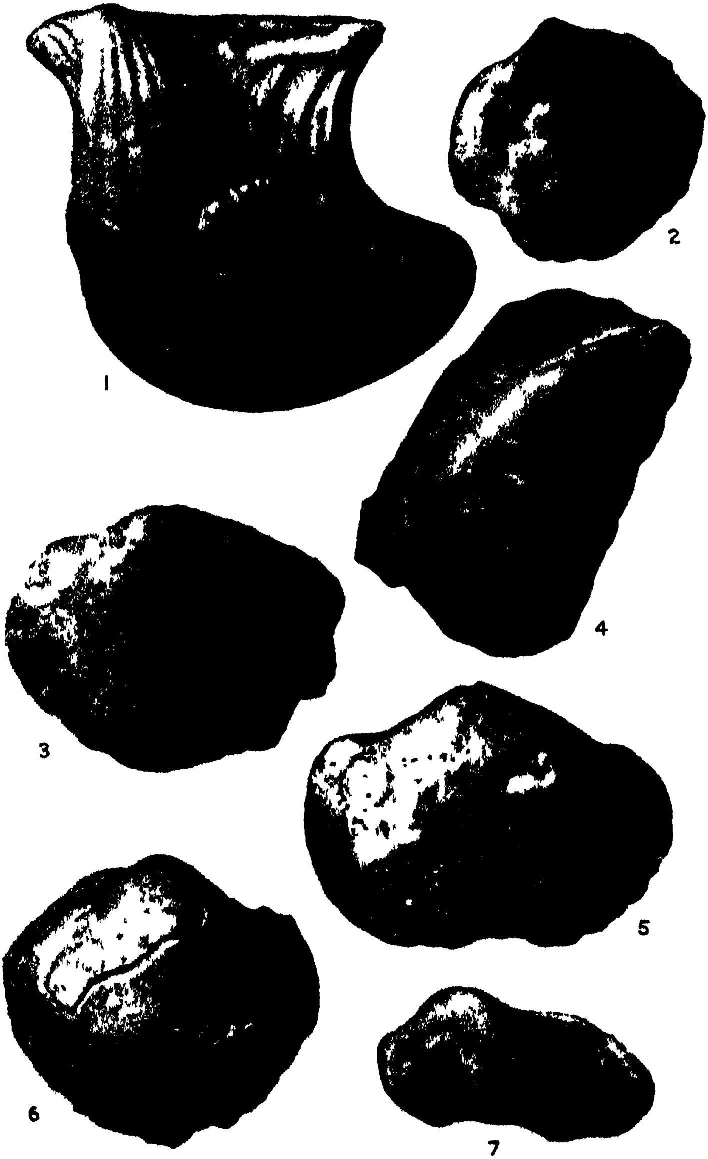

UPPER JURASSIC LAMELLIBRANCHIA FROM SOUTHERN ARABIA.

Fig. 1.

Fig. 2.

Fig. 1. Peripatopsis moseleyi.
Fig. 2.—Peripatopsis sedgwicki.

FIG. 3.

FIG. 4.

Peripatopsis moseleyi.

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